RAILROAD GAZETTE

LOCOMOTIVES AT THE WORLD'S FAIR.*

Large boilers, wide fire boxes and high pressures are the features of the locomotives at the World's Fair which are most prominent and which most clearly point the progress that has been made since 1893. These might be summed up in the simple term bigness, as that has been the dominant object in the improvements that have been made. In the never-ending quest for economy in transportation—which we translate into the term large train-load—the largest factor is saving of wages on trains, and the bigger the engine, the smaller the aggregate wages. If our engines had been improved in size alone a great advance would have been made.

This development of the steam locomotive during the past eleven years has been eminently rational, the three principal changes named being based on principles long recognized as fundamental and important. A large boiler to carry a reserve stock of heat is an essential element of economy, and the wonder is that we did not energize our ingenuity enough to adopt it twenty years ago, when Mr. Forney told us to do so. The wide fire box becomes an easy problem when we put small wheels under it. High pressure has not been so easy an attainment, but everybody now seems to appreciate it, and to see the waste of making a big and costly machine and then not getting full value out of all its parts.

High pressure has in part taken the place of compound cylinders. Compounding is still appreciated, but the Vauclain four-cylinder compound of 1892, has not swept the field as some thought probable in 1893. The only engine of this class at St. Louis is one built for the Burlington some years ago and which is shown for the splendid record that it has made with the fast mail trains of that road. This engine (No. 1587) in two years ending March, 1904, ran 137,856 miles, hauling trains averaging eight cars. The mileage named equals 6,893 miles a month, exclusive of the time the engine was in the shop. In one month it made 12,211 miles. The engine is of the well-known Atlantic type, often described; cylinders 15 in. and 25 in. x 26 in. The Baldwin works exhibits at St. Louis a two-cylinder compound, built for the Norfolk & Western, a consolidation freight engine; and the four-cylinder balanced compound for the Burlington described in the *Railroad Gazette* June 3 last.

The piston valve, which Mr. Vauclain introduced with the four-cylinder compound, has retained the favor which was accorded it and now appears in many simple engines. It is unnecessary to remark that the popularity of this valve is largely due to the universal demand for high speeds, requiring perfectly balanced valves.

The completeness of the conquest which the wide fire box has made is indicated by the fact that of the thirty-nine locomotives shown at the fair, nearly all standard gage, only three of that gage have fire boxes wholly between the wheels; and one of these is a switcher, built for a private industry. But only one of these wide fire boxes is of the extreme (Wootten) type, though that type still enjoys favor in its own country—that is, on the Reading, the Lackawanna and the Lehigh Valley. The Atlantic type (4-4-2) was made necessary by the development of the wide fire box, and now the Pacific type (4-4-2) designed for heavier trains, bids fair to become equally familiar on all large roads. Of the Atlantic type there are five engines and of the Pacific (and Prairie) four. Of the seven consolidation engines two have 5-ft. driving wheels. There are two ten wheelers and two moguls. There is a narrow gage mogul built for the Kiushu railroad of Japan, a six-wheel switching engine of moderate size and a very small four-wheel contractor's engine. The most powerful passenger engine is the four-cylinder balanced compound shown by the New York Central, designed by Mr. Cole, and weighing 200,000 lbs. This engine was described in the *Railroad Gazette*, May 13: The weight on the drivers is 110,000 lbs.; cylinders, 15 and 26x26; heating surface, 3,446 sq. ft., and grate area, 50.3 sq. ft.

The largest freight engine is the Baltimore & Ohio articulated 12-wheel Mallet, described in the *Railroad Gazette*, May 27, 1904,† and next to it comes the Atchison, Topeka & Santa Fe tandem 4-cylinder compound, described in the *Railroad Gazette*, October 9, 1903.

We all gaze in wonder at the elephantine proportions of these huge machines, and yet, for the service for which they are designed, why should they be considered large? On a two per cent. ascending grade the Atchison engine propels about 1,100 tons at a speed of five miles an hour. The articulated engine is expected to move about 1,500 tons. In other words, the Atchison engine, if hitched to a train such as an 85-ton engine, hauls on a level at 20 miles an hour it could not keep it going up a steeper grade than about 35 ft. to the mile, even at the lowest practicable speed. To take up such a grade one of the 80-car trains now becoming common on our level railroads, the leviathans will have to be made even larger yet. It may be necessary to push instead of pull such loads up a hill, in order to avoid damage to draw gear; but that cannot be called an insuperable obstacle. The desideratum is, of course, to make an engine to use on steep grades, powerful enough to take up such grades a full level-road train, and thus save remarshalling the cars. So far as anyone can now see, we are not likely to be able to carry out this idea with steam locomotives except on lines with unlimited side and head clearances.

Esthetics governs, to some extent, in engines as well as in passenger cars, but in engines, as in sky scraper buildings on narrow streets, the Goddess of Beauty has harder and harder work year by year to keep from being buried out of sight. Stacks and cabs are about the only features left in which even a half-inch frill can be retained, and these are fast giving up the fight. We shall be driven to the alternative of restoring a few of the gold stripes of former years, or else of being content with the coal-mine mole type of engine for all slow trains. In tenders, the Vanderbilt type, of which there are three at the fair, exemplifies the extreme opposite of beauty.

Everything mentioned in the foregoing notes is American, the American Locomotive Company, the Baldwin and the Rogers works comprising the short list of builders. The Lima Locomotive & Machine Works shows one of its geared engines and the Canadian Locomotive Works, of Kingston, shows a narrow gage engine built for the Prince Edward's Island railroad; and that ends the list for America. Europe is represented by the deGlehn compound imported from France by the Pennsylvania Railroad and four German engines. Of these we shall have something to say in a subsequent issue.

In saying that the St. Louis exhibit is, as a whole, an exhibit exclusively of things accomplished, we must make an exception of the four-cylinder balanced compounds, of which there are four at the fair. (Of these our readers have already been told; the de Glehn, P. R. R.; the Cole, N. Y. C.; the Vauclain, C. B. & Q. and Henschel.) These engines represent progress rather than present achievement. But the heavy and fast electric locomotive, such as the New York Central hopes to show to the world before long, and which embodies at least as significant and as earnest hopes of progress as any steam engine, is conspicuous by its absence.

*Continuation of article on the World's Fair in the issue of Sept. 23, page 353.

†The B. & O. engine has six pairs of drivers arranged in two groups of three pairs each. The high-pressure cylinders which drive the rear group are 20 in. x 32 in. and have piston valves. The low-pressure cylinders which drive the forward group are 32 in. x 32 in. and have slide valves. The exhaust from the high-pressure cylinder, in each side, passes forward through an outside pipe to the low-pressure cylinder. The locomotive is the heaviest in the world, and weighs 334,500 lbs. The boiler contains 5,586 sq. ft. of heating surface, and the grate area is 72.2 sq. ft. The Atchison engine is the 2-10-2 type and weighs 287,240 lbs., with 234,580 lbs. on the drivers. The heating surface is 4,796 sq. ft., and the grate area is 58.5 sq. ft. The cylinders are 19 in. and 32 x 32 ins. and the drivers are 57 ins. in diameter. The tractive effort is about 62,000 lbs.

A STEAM-ELECTRIC UNDERSTUDY.

The conceded fact that we are at the dawn of important readjustments in the relation of steam and electricity as carrying powers has led to much study of the subject, both on its positive and its speculative side. But that study has borne almost exclusively on the physical aspect of the question. This is natural enough. Logically we look at the mechanics of such a question as a kind of major premise to be accepted—or, at least, fully tried out—before we exercise ulterior problems. But some of the latter have begun to enter the field of prevision. One example, the "Consolidated," is already a fact and not a hypothesis. In his annual report President Mellen, of the New Haven road, referred to the transfer of large electric properties of his company to this new corporation, the "Consolidated Railway Company," which, of course, the New Haven owns and controls. The transaction, already known to our readers, was the selection of a remote and intrinsically weak trolley company—but one holding a very liberal and expansive charter—as a basic corporation for financing, consolidating and ultimately enlarging the electric properties of the steam parent company. The process is familiar. But let us glance at some of its ulterior meanings.

Steam railroad charters as a general rule are uniform in their powers, so far as relates to their function, namely, transportation. They are still more uniform within the bounds of single States. But the electric

charters are far from uniform. They vary much not only in different States—especially as regards long and short distances—but in particular States. Some of them allow specifically transportation of passengers alone; others include freight and express service; and still others give power to sell light, power and heat to corporations and individuals, besides vague but immense power of lease, merger, purchase and consolidation with other lines. The charters have often been granted hastily, rashly and in a local frenzy of electric construction. It follows that the steam corporation, owning half a dozen electric lines and consolidating them on the basis of the most liberal charter held by any one of them, amplifies functions extremely. Potentially and probably we shall find the original steam corporation—whether it finally discards steam or not—selling light, power and heat, and in possession of such latitude of extension and merger as the Legislature never intended to grant or dreamed of granting. Legislatures can, of course, alter, amend or repeal charters; but, in practice, it is almost never done. Not without a certain prophetic insight has the State of Massachusetts adopted as a policy a limitation on electric railway companies almost tantamount to a prohibition of selling light and power.

In the category of these secondary and derived powers obtained by the steam corporation through its electric charters the most noteworthy is that of increased capitalization of the acquired lines. But as a matter of record those lines in probably four cases out of five had been overcapitalized already. To bonds watered originally, or, at least, marketed below par, has been added watered stock, and sometimes the hose has been turned on over and over again, usually on the occasion of some large merger or consolidation—as witness the case of the Rhode Island Electric. Will the steam companies resist the temptation to new electric capitalization as they take in, combine and "consolidate" their electric plants? So far as concerns the investor the query is, perhaps, not material, for the greater and stronger corporation stands behind his electric railway security. But as regards the public and its right to such "reasonable" fares as will pay fair dividends on actual cash investment, the proposition is a different one. It will be said with some truth that the new, closer and more intense relation created between the public and the steam road through electric ownership increases corporate responsiveness to public demand. In the long run this principle may work out results, but, as a rule, it will not do so rapidly.

The great steam corporation which buys in a group of electric roads can adopt one of three policies. It can (1) leave them as technically independent lines and secure its own ends either by thwarting competition and taking profit in dividends. The plan has, from the controlling corporation's viewpoint, the merit of simplicity, and, in form at any rate, of masking to some extent corporate responsibility; but it is not likely to be economical. The corporation can (2) consolidate its electric lines under a "holding" company, or (3) can merge them absolutely as part of itself, provided it has complete ownership of stock. One of these last two methods we are likely to see as steam railroad ownership of electric lines is evolved. It will give rise to some interesting questions both in general State legislation and as regards the power of State railroad commissions over returns. In effect we have one such case in Massachusetts already, where the railroad commisison treats a great holding corporation—though not a steam railroad company—merely as an individual stockholder, and insists on separate returns from its many controlled lines. It is probably a type of other instances to come as the tie between electricity and steam draws closer and supplies its new situations.

At this writing the "deal" of the New York, New Haven & Hartford for acquiring the New York, Ontario & Western appears be still in the works, though it may be a finished product before our readers see these lines. Whatever the outcome, it will be either the climax or the anti-climax in a most important branch of President Mellen's policy. When that vigorous and experienced officer bought control of the Central New England and the Poughkeepsie Bridge several months ago the anthracite coal fields became almost necessarily an objective. His next step in his excursion westward was obviously to be an expansion of the coal traffic, to be accomplished either by a "belt" line connecting with the existing coal roads or by acquiring a coal road of his own. There can be little doubt that the reported negotiations some four months ago over the ownership of the Lehigh & Hudson River line had the coal traffic as a *motif*, and there may have been more of finesse on the part of the coal road managers in defeating that plan than has appeared on the surface. At any rate Mr. Mellen seems to have had an option on the Ontario & Western as an alternative. Whether that option finally proves to have been exercised or not, its significance is large. It includes for the New Haven an independent coal supply; the traffic arising from coal fields owned by the Ontario & Western, estimated at not less than $5,000,000 tons yearly for twenty years, besides large traffic from independent coal producers; an unbroken and pretty direct rail line from the mines to the New England cities and factory centers; and, potentially, a new link in a trunk line to the West. More remotely the "deal" bears affirmatively on the question of the New Haven's retaining its old profits in the division of Western freight rates. But, quite apart from such special features, the control of the "OW," if actually accomplished, is dramatic as a new expression of the radical Mellen policy. Even President C. P. Clark, in his most aggressive moods, never contemplated invasion of the coal fields. Yet just that thing, and presumptively in the face of the opposition of the great operating coal companies, appears to be what Mr. Mellen has done, adding a new and sensational chapter to the story of his first year's administration.

Opening of the New York Subway.

By the time this paper reaches the reader the establishment of real "rapid transit" on Manhattan island will be an accomplished fact, the Interborough Rapid Transit Company having announced that the running of regular trains for the public from the City Hall northward to 145th street and Broadway, nine miles, would be begun at 7 o'clock on the evening of Thursday, October 27. A simple celebration at the City Hall in the afternoon was the only public recognition of the event. This nine-mile stretch constitutes the most immediately important part of the undertaking, being the part for which there has been for ten years a pressing necessity; and it has been completed within the contract time, in spite of the numerous and varied difficulties which have beset the commission, the city authorities and the contractors. For the last two months the officers of the operating company have been constantly engaged in the arduous task of instructing the many hundreds of new trainmen in their duties. This work appears to have been done successfully. Scores of trips have been made every day, and every feature of the structure and equipment and all of the appliances were thus thoroughly tested weeks before the opening. For the present the trains on the local tracks will consist of five cars each. These will be run from 5.30 a.m. to midnight at three minute intervals, and from midnight to 5.30 a.m. at intervals of from five to ten minutes. The express trains will be made up of eight cars and will run at five minute intervals from 6.30 a.m. to 7 a.m.; from 7 a.m. to 9.30 a.m. at four minute intervals; from 9.30 a.m. to 2.30 p.m. at intervals of from five to ten minutes; from 2.30 p.m. to 4.30 p.m. at five minute intervals; from 4.30 p.m. to 8 p.m. at four minute intervals; from 8 p.m. to midnight at five and six minute intervals, and from midnight to 6.30 a.m. there will be no express trains. It will be several weeks before the Lenox avenue line will be ready for use, even as far as the Harlem river. The extension of the west side line across the flats to Spuyten Duyvil, and the line under the Harlem and into the Borough of the Bronx will not be completed for some time. The portion now opened will greatly relieve the congestion of traffic on the elevated lines during rush hours, especially on the west side.

September Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of September, printed in another column, contains accounts of 20 collisions, 22 derailments, and one other accident. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

		Killed.	Injured.
6th.	Carman, Pa.	2	3
6th.	Pendleton, Mo.	8	39
7th.	Chagrin Falls, Ohio.	2	3
7th.	Tiskilwa, Ill.	4	30
10th.	Monroe, N. C.	5	12
24th.	Hodges, Tenn.	59	100
25th.	Lock Berlin, N. Y.	1	24
27th.	Wheeler, Kan.	..	..

The worst accident in this list, the Hodges collision, has already been reported. The only significant thing that has since occurred in connection with it is the order, which has been issued on the Southern Railway, to run the heaviest passenger cars in the front portion of trains. To what extent this order is applied, or how long it is to last, we do not know. To run sleeping cars in the front portion of any train which carries most of its passengers in ordinary coaches is a source of constant inconvenience, and of frequent annoyance, and the true remedy for the danger connected with the use of light cars in the front part of trains is to provide heavy cars—or cars with greater longitudinal stiffness—to take the place of the light cars. Light cars need not be thrown away, of course; for if they are sound they are as

good as ever they were, provided they are run in trains by themselves.

The next three accidents, in the order of their magnitude, are due to causes more nearly unpreventable than usually will be found in a group so close together. The Pendleton derailment is unexplained, an officer of the road reporting that diligent search revealed no fault in cars, engine or track; and the speed was not excessive. At Monroe the evidence that track bolts had been purposely removed is said to be conclusive; and the Tiskilwa wreck is chargeable primarily to a cause—brake-hose failure on a freight car—which is difficult to provide against completely. (This is not saying that the brake connections of all freight cars are as regularly and carefully inspected as they ought to be.) The accidents at Monroe and Lock Berlin are alike in that passengers who escaped with their lives from the derailment were killed by another train running into the wreck. In the Lock Berlin case this addition to the original wreck may be charged directly to the density of traffic—on a single track railroad it could not have occurred. At Monroe the trouble was that in the first wreck all of the trainmen were disabled so that a flag was not sent back; the block system would have saved the freight engine, and the lives of those on whom it fell.

Four notable train accidents occurred in Canada in September. On Thursday night, September 1, at Sintaluta, Assiniboia, the Imperial Limited ran over a misplaced switch and collided with a freight train, killing five passengers, and at Eastwood, Ontario, on the 28th, four employees were killed in a collision of freight trains. The other two accidents were at Dexter and at Medicine Hat.

The number of electric car accidents reported in the United States in the month of September was 24, killing 23 persons and injuring 142. Of the fatalities, nine were due to the explosion of a box of dynamite at Melrose, Mass., as reported in our issue of September 30, news page 105; and seven others are chargeable to the crossing accident at St. Louis, September 1, where a street car was run into by a locomotive. (*Railroad Gazette*, page 314 and news page 81.)

Cleveland, Cincinnati, Chicago & St. Louis.

The report of the "Big Four" for the fiscal year shows a gain in gross receipts of $679,292, of which passenger earnings contributed the creditable amount of $600,387, due in part to the increased business derived from the World's Fair traffic to St. Louis. This gain from passenger traffic combined with increases in mail and passenger earnings, helped to offset a decrease of $180,434 in freight receipts. As no tables are given of the class of freight carried, it is impossible to tell in what commodities the loss in freight occurred, and the report says that the traffic was there, but that it could not be moved owing to congestion. The decrease in ton mileage was 107,668,923 tons, or 5.2 per cent., while the average haul fell from 162 miles to 156 miles, and the average train load from 333 tons to 326 tons. The steady increase in train load which started in 1893, when it was 210 tons, culminated in 1900, and since then the average has fluctuated back and forth without showing permanent gains or losses. A higher average rate (6.70 mills per ton mile) helped to offset somewhat the loss in tonnage. This figure compares with 6.44 mills in 1903 and 5.92 mills in 1902.

In spite of decreases in the maintenance of equipment and maintenance of way accounts, operating expenses for the year increased $1,060,797. This was caused by unusually heavy charges against conducting transportation, which amounted to $1,126,016 more than in 1903, the item for cost of coal alone increasing $124,264 over last year. An increase of $197,712 for injuries to persons also helped to swell the total charges against conducting transportation. This was the result of the fatal accident to a special train last October, when 16 passengers were killed and many injured. Another addition to expenses was due to the increase in charges under the per diem freight car rule resulting from freight congestion. For the first nine months of the current year the charges for balance of car service amounted to $500,000, or $200,000 above normal. The more important statistics of operation follow:

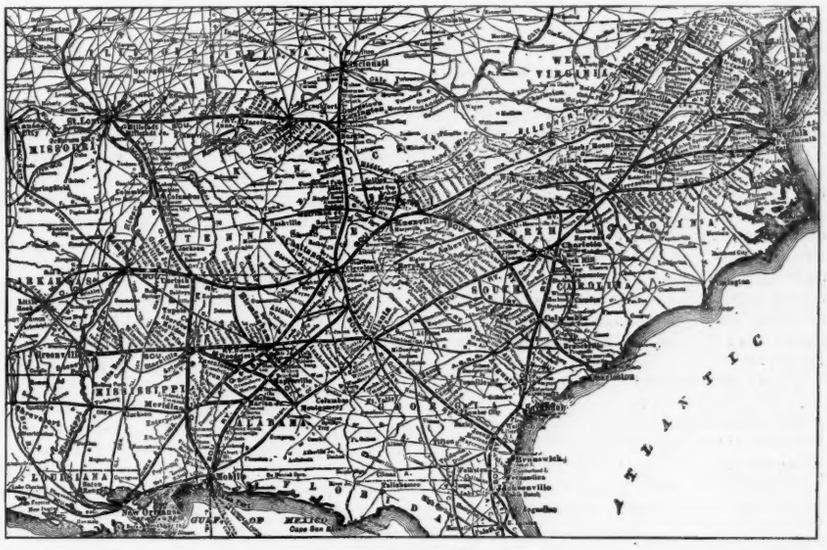
	1904.	1903.
Average mileage worked	2,287	2,287
Gross earnings	$21,069,954	$20,390,762
Freight earnings	13,053,864	13,234,298
Passenger earnings	6,378,878	5,778,490
Operating expenses	15,403,966	14,470,055
Maintenance of way	2,723,131	2,884,107
Maintenance of equipm't.	3,078,682	3,180,285
Conducting transportat'n	8,588,133	7,462,116
General expenses	390,501	344,367
Traffic expenses	623,519	599,181
Net earnings	4,339,728	4,721,331
Balance	1,472,506	1,877,269

Southern Railway.

Gross earnings for the year ending June 30 were in round numbers $45,000,000, nearly $3,000,000 more than in 1903. The Southern as one of the first bankrupt properties reorganized by Mr. Morgan has a peculiar interest. So far it has not realized as large results as some other properties reorganized at the same time, but there has been a steady growth. The directors have been much embarrassed by the necessity of taking in a large number of lines which were not immediately paying but were necessary to secure control of territory through which they operate. In addition to this the company early started upon a policy of preferred dividends which have severely strained its resources. In the year 1904 for the first time there is a fair surplus left after dividends have been paid, and from now on it may reasonably be expected that the surplus available for dividends will each year put the railroad in a stronger position. The surplus above dividends this year amounted to $1,180,000, enabling the company to appropriate nearly $800,000 for improvements and betterments.

Each year since the reorganization of the property the annual report has told of the acquisition of considerable new mileage. This year the actual increase was but 60 miles, all told, and the increase in the average mileage operated during the year only ten miles. The extensions have been little feeders to the main line, the principal one of which is the Knoxville & Bristol in eastern Tennessee, about 40 miles long.

The locomotive roster was increased by the net addition of 125 locomotives, 139 being added and 14 being retired. Of the present locomotive equipment therefore about 12 per cent. is less than one year old. The larger capacity of the new locomotives has raised the hauling capacity of the average locomotive from 3,888 to 3,891 tons, an improvement of 8.1 per cent. The net addition of passenger train cars is 18 cars, 45 being added and 27 retired; therefore about 5 per cent. of the passenger equipment is less than one year old. The freight equipment shows a decrease of 418 cars. While 1,104 were added 1,522 were retired. The average capacity of freight cars has increased only about 1 per cent. The features of financing of the year were an issue of $15,000,000 of the authorized $16,000,000 collateral 5 per cent. gold bonds maturing in five years after April, 1904, but redeemable in two years. Over $10,000,000 of this was to retire outstanding certificates of indebtedness issued at various times since 1897; and $4,000,000 collateral trust bonds of September 1, 1901, were also retired. For new equipment acquired further issues of equipment trusts were made, aggregating about $2,700,000. The payments on outstanding trusts of about $2,000,000 made the net increase in outstanding car trusts about $700,000. As it now stands some 11,000 freight cars, 34 passenger train cars and 354 locomotives have been purchased by equipment trust arrangements aggregating a stock of about $15,000,000, of which $7,000,000 has been paid, leaving about $8,000,000 unmatured and outstanding.



Southern Railway.

The Knoxville & Ohio Railroad, which has up to this time been preserved as a separate entity, though its stock has been owned entire by the Southern Railway and the property has been operated as an integral part of the general system, was this year merged into the Southern Railway. The mortgage of the Southern Railway Company first consolidated mortgage heretofore raised on the capital of the Knoxville & Ohio was thus extended to the property itself. Of the stock of the Mobile & Ohio $700,000 was taken up this year and collateral trust certificates issued against it.

The company has evidently been improv-

ing its terminals. At New Orleans the New Orleans Belt & Terminal Co. has been consolidated with the New Orleans Terminal Co. An agreement has been made for the joint use of these facilities by the Southern and the Rock Island systems. The stock, which amounts to $2,000,000, is owned in equal proportions by the two parties and there has been issued $3,000,000 first mortgage 4 per cent. gold bonds which are guaranteed by the Southern and the St. Louis & San Francisco (Rock Island). At Charleston the Southern has united with the Atlantic Coast Line, taking over in a foreclosure sale the East Shore Terminal Co., which property consisted of terminal tracks, wharves and warehouses on the water front. In addition to this there have since been acquired water front and terminals formerly belonging to the South Carolina Terminal Co. The Southern Railway has abandoned its Mississippi river barge line, turning over the business to a separate organization known as the Monongahela River Consolidated Coal & Coke Co.

During the year there has been spent on the property besides the amount spent for equipment $5,129,000. Of this amount $641,000 was charged to income as special improvements and betterments not capitalized. The remainder, or $4,488,000, was charged to capital. The two largest single items of expenditure were about $2,000,000 for second track and revision of line from Alexandria to Orange, Va., and two other sections of second track a short distance at Asheville and at Spartanburg, together with the revision of line at other points on the Asheville division and on the St. Louis division. The other considerable item is the amount of over $1,000,000 on account of the acquisition of the Knoxville & Ohio, the Tennessee & Northern and the Knoxville & Bristol. Of the remainder of the amount charged to construction about $500,000 was for spurs and extensions, of which the principal one was the Okalona Big Creek line in Mississippi; and $300,000 more was spent for passing tracks and tracks to industrial sidings. About $100,000 was spent on terminals and the balance went for buildings, shops and warehouses.

The income account is as below:

	1904.	1903.	Increase.
Gross earnings	$45,109,777	$42,354,059	$2,755,717
Expenses	33,115,467	30,989,139	2,126,327
Net earnings	$11,994,310	$11,364,919	$629,390
Other income	1,395,181	1,211,261	183,919
All income	$13,389,491	$12,576,181	$813,310
Charges	9,209,091	8,733,704	475,387
Surplus	$4,180,399	$3,842,477	$337,922
Dividends	3,000,000	3,000,000	.....
Balance	$1,180,399	$842,477	$337,922
Betterment, &c.	773,806	135,000	638,806
Balance	$406,593	$707,477	*$300,883

*Decrease.

Gross earnings increased 6.43 per cent., while expenses increased 6.77, and this increase was almost altogether in transportation expense, only about $300,000 of it being in maintenance. Maintenance of way is practically the same figure as last year. In maintenance of equipment the expenditure per locomotive was $3,024, per passenger car $956 and per freight car $69; these are very fair figures and for locomotives are more than liberal.

Transportation expense has increased $1,567,000, which amounts to about 10 per cent., while ton mileage has increased 11 per cent. and the passenger train mileage 3 per cent. In other words conducting transportation has increased about as rapidly as the amount of transportation done. This is not a bad showing, when compared, for example, with the trunk lines; that the increase is no larger is a matter of congratulation, though we should not expect to find so large increases in the south as in the west and north. In the detail of transportation expense there is one item which is conspicuously bad, namely, the increase in the expense of wrecks and loss by damage. In 1904 it reached the huge figure of nearly $2,000,000, or over 11 per cent. of the entire amount of transportation expense. The increase during the year was $453,000. This points to a condition of operation that is far from satisfactory. If this heavy wreck expense could be eliminated the general showing of conducting transportation would be satisfactory.

The increase in earnings is fairly well distributed. The passenger earnings have increased $500,000 and freight earnings $2,000,000. The increase in freight earnings is in face of a slight decline in average receipts. The freight train load is at the very low figure of 190 tons, barely above the figure of the year previous. This may be largely accounted for by the large number of branches and lines where light train mileage must be made; but it is very low and as a result the freight train earnings per train mile are $1.77, which is practically the same figure as last year. To sum up, the Southern Railway is growing with the growth of the territory which it serves. The transportation expense has been held fairly well in hand except in the item of wrecks.

NEW PUBLICATIONS.

The Detailed Design of a Railroad Bridge. By William H. Burr, C. E., and Myron S. Falk, C. E. Reprinted in pamphlet form from the School of Mines Quarterly for April and July, 1904. Columbia University Book Store, New York. Price 75 cents.

The matter in this pamphlet has been prepared to take the place of much of the theory and discussion on railroad bridge design in Chapter 10 of the eighth edition of Burr's Stresses in Bridge and Roof Trusses. It will form a separate chapter in the completely re-written edition of that book which will soon be published. The design of a bridge is taken up, beginning with the assumed live loads and the determination of the live and dead load stresses in the members. This is followed by the determination of the wind stresses and the design of the detailed parts of the bridge. The bridge which has been considered is a 350-ft., single-track, through span, and the principles outlined indicate a system of rational treatment for the design of all parts of almost any type of modern trussed bridge.

Tunneling. By Charles Prelini, C. E. Second edition. New York: D. Van Nostrand Company. Cloth, 307 pages. Price $3.

This is a practical treatise on tunnels and modern methods of tunneling. It takes up in order the preliminary considerations of cost and tunnel location, methods of excavation, methods of timbering tunnels, lining, driving tunnels through hard rock and through soft ground, submarine tunneling, ventilation and lighting during construction, and some valuable notes and data on the cost of tunnel excavation and the time required for the work. Numerous examples of modern tunneling methods have been treated at length in the descriptions and a large number of diagrams and illustrations have been included to make clear the text. The few books which have been written on this subject are of little practical value because they are old and obsolete, but this book is an excellent one for those who have to do with tunnel construction.

TRADE CATALOGUES.

The Associated Expanded Metal Companies, New York, which represents 12 different companies that make expanded metal, is distributing a catalogue containing about 65 handsomely illustrated pages 9 in. x 12 in. Full size illustrations of the standard sizes of expanded metal are shown. The method of making this material is explained and a brief but comprehensive discussion on the expanded metal system of reinforced concrete construction is given. This includes a theoretical explanation of reinforced concrete, practical tests, fire resisting qualities, the durability of steel embedded in concrete, etc. This is followed by descriptions and illustrations of different methods of construction, for floors, roofs, partitions, outside walls, etc. The use of concrete in sewers, subway construction, railroad work, etc., is also spoken of. Anyone having to do with reinforced concrete construction will find this catalogue of interest.

The Acme Sheet Piling Company, Chicago, in a small 12-page pamphlet describes Acme pressed-steel sheet piling and Acme combination sheet piling. The former is simple in form and the builders state that it can be driven with a heavy sledge and withdrawn with a hand lever. It is supplementary to the standard metal piling of the company, being intended for applications where heavier and stronger piling is not required. The combination piling is a new form, being an interlocking piling principally of wood, and not expensive. It is made to interlock by angles which are bolted to the plank with one leg parallel to, and a short distance from, the edge. On the opposite face of the plank to which the angle is bolted, at one edge only, a plate is held by the same bolts which secure the angle, the plate, angle-leg and plank-edge forming a channel into which the angle of the adjacent pile is slipped.

The Lima Locomotive & Machine Company, Lima, Ohio, sends two catalogues, Nos. 10 and 12. The yards and buildings of this company cover an area of 15 acres of ground, and the floor space in the building is about 200,000 sq. ft. The average capacity of the plant is one locomotive per day. Catalogue No. 10 describes and illustrates the leading styles and sizes of the locomotives made, and catalogue No. 12 shows the various sizes and latest designs of the Shay locomotive together with tabulated statements of their ratings and views of the engines at work. It also contains both interior and exterior views of the new works of the company. Both catalogues devote a number of pages to useful engineering data and also contain a telegraphic correspondence code.

The De Laval Steam Turbine Company, New York, sends its general catalogue in which is given a full detailed description of its steam turbines. It also sends its bulletins Nos. 2, 8 and 9, which are descriptive of the company's direct current turbine dynamos, train lighting with steam turbines, and a test of the De Laval centrifugal pumps.

CONTRIBUTIONS

Defective Train Rules.

To the Editor of the Railroad Gazette:

During the world's fair in 1893 there was an epidemic of collisions which was partly accounted for by the exceptionally heavy passenger travel. About four years ago there was another outbreak of this nature, and

now again we are having serious railroad disasters more frequently than at any time in our history. Speculating upon what the next cycle may have in store for the traveling public is a melancholy occupation. There is little comfort in the threadbare assumption that as long as there are railroads there must be just so many collisions; that it is beyond the power of human agency to anticipate, mitigate or prevent them.

Discussion of the ulterior causes which have led up to these collisions may be the means of preventing repetitions only if those in authority who read and learn of the weak rules, or unsafe practices under the rules, which brought about the accidents, will take the necessary steps to correct the defects discovered; but, unfortunately, it is human nature to dismiss published comments on collisions, and suggestions for relief, by some such remark as "yes, the suggestion is undoubtedly a good one and if adopted would no doubt prevent many similar collisions, but we have never had an accident from that particular cause and the probability of our ever having one is too remote to make it necessary for our company to take steps to prevent it. Our men have been educated up to a higher standard of efficiency, and, besides, they are all old in the service and have had wide experience. Perhaps when business picks up we may feel warranted in spending some money in this direction. It will involve a considerable outlay."

This has been a year of disastrous floods, and it is told of at least one official who, upon reading of an account of the loss of many lives by a washout, issued unusually detailed cautionary instructions to trackmen, trainmen, enginemen, despatchers and operators. That particular road has got through the year without an accident of this nature. It will not be argued that there would have been loss of life from this cause if he had not taken such precautions; it may have just happened so; but it is an interesting query whether this officer, when he read of a recent collision which resulted in great loss of life, by reason of a conductor and engineman forgetting their orders to meet a train, became equally alarmed as to causes of collisions and took the necessary prompt steps to prevent a like accident on his road by ordering that thereafter all train orders directing trains to meet at telegraph stations must be addressed in duplicate to the operators at such stations, and that that operator must be known to have displayed his order signal at "stop" before either train is permitted to act on the order.

In another case, a freight train overlooked the signals on the engine of the first section of a passenger train; did this man order that freight trains should thereafter be regularly advised when it was found necessary to run passenger trains in sections, especially if on his road such a practice is rare and unusual? Are his local and branch trains sometimes ordered to display signals for a following section without notice being given to inferior trains? Are his despatchers in the habit of mentioning "No. 1" in train orders, as permitted by Rule 218, when that train is running in several sections? Is he depending upon Rule 96 to protect opposing trains when signals are taken down? Or is he in other ways allowing needless traps to be set to test the wits of his conductors and enginemen? In short, do officers who can see the dangers of washouts and provide against them, keep their eyes equally well open to the dangers of collisions? Collisions may be less frequent than washouts and their causes are perhaps harder to combat, but on the other hand they cause more death and distress when they do happen.

The present is a very opportune time to look into these matters. A start might be made by taking up Rule 96* for investigation. How is it understood and handled on your road? At first glance it may seem to be sound both technically and theoretically, and if flagmen always use good judgment, possibly it may be, but there are serious defects in it and it does not fully cover the ground. In two ways collisions are possible under a strict observance of and dependence upon this rule. No provision is made for notifying extra trains when signals are taken down. Under the new rules, extra trains are not represented on time-tables and cannot, therefore, be considered as classified trains. Again, if an inferior class train were to be directed to meet a superior class train, without the sections of the inferior class train being mentioned in the order (under Rule 218, this mention is not compulsory) and signals are taken down on the leading section of the inferior class train at the meeting point, before the following sections arrive there, the flagman protecting such inferior class trains might construe the rule as instructing him not to notify the superior class train that there were sections of the inferior class train, made superior by right, yet to arrive. Everyone may live up to the requirements of the rule and still a collision may occur at a station under it. Suppose that there is a station on a curve where the view is obstructed by hills, buildings or fog, and that signals are taken down at that point without advance notice being given the following section that it will be annulled from such station. This following section, if it has precedence, will come into this station on the main track and, although the order signal indicates stop, it will quite likely pull a portion of its train past the signal before stopping. Meantime, the first section, which we will now call No. 1, has reached a station beyond and there meets an inferior train. This inferior train, observing that No. 1 is not displaying signals, moves forward and also pulls into this obscured station, where the signals were taken down, on the main track and a part of its train also passes the order signal, or would have done so had it not collided with 2d No. 1. Who is at fault for the collision? When 1st No. 1 took down its signals the operator was probably notified, according to rule, and he displayed his order signal at "stop" (although the rule does not instruct him to do even this much) to advise opposing trains, but what good did it do? There was a collision under the rules before the men on either train had had an opportunity to get to the telegraph office to ascertain why the signal was at stop.

Is not the matter of taking down signals clearly one to be looked after more closely by the despatcher? Should not he advise interested trains before they arrive at the station where the section annulled is to lose right and class? If may be said that the engine of a train must not pass an order signal indicating stop until the engineman finds out why it is thus displayed; but a trip over any road will convince anyone that such a claim is nullified by every day practice. Passenger trains often pass such signals in order to pull baggage cars and coaches up to the proper place at a station to enable necessary work to be done. Freights often run past, to save a bad extra stop.

A recent collision which resulted in loss of life and damage to property occurred through dependence upon Rule 96. A freight train moving from A to Z was given right from A to E over the third section of a superior freight train moving in the opposite direction. Upon arrival at E the inferior train simply inquired as to whether the third section had arrived and, upon ascertaining that it had, proceeded toward Z and collided with the fourth section. The third section had been turned back from E and the crew of the inferior train failed to ask the operator, it appears, whether or not the third section arrived *displaying signals*. It may be that the despatcher was depending upon the operator to notify opposing trains of this fact, and the operator may have taken it for granted that the inferior train had orders that permitted it to proceed against the fourth section. How simple a matter it would have been for the despatcher to have advised this opposing train that there were four sections of the superior train between E and X and saved those precious lives. If there had been a train register at E this need not have been done. H. W. F.

*When signals displayed for a section are taken down at any point before that section arrives, the conductor will, if there be no other provision, arrange with the operator, or if there be no operator, with the switchtender, or in the absence of both, with a flagman left there for the purpose, to notify all opposing trains of the same or inferior class leaving such point that the section for which the signals were displayed has not arrived.

Tests of Locomotives on the French State Railway.*

During the years 1901, 1902 and 1903 the French State Railway carried out an extended series of tests on five different types of locomotives, including two American-built engines which it had bought. The tests were made for the purpose of examining the efficiency of operation of the steam in the cylinders, and at the same time testing the applicability to the locomotive, of a theory of the steam engine previously developed by Mr. Nadal. It was also thought that the comparison of the performances of locomotives of such varied types could not fail to be instructive.

For the purposes of the tests the locomotives were observed when handling local and express trains in regular service. Indicator diagrams were taken at frequent intervals and the coal and water consumption noted. In comparing the results of the tests the following points were examined: The fall of pressure between the boiler and the cylinders was observed and the indicator diagrams were carefully analyzed, the apparent or indicated steam consumption being calculated and compared with the actual measured water consumption; also the form of the expansion curve was examined. The tractive effort was calculated from the diagrams and the resistance of the locomotive and tender determined.

The arrangement used for taking the indicator diagrams was simple but accurate. The motion is taken from the crosshead by a swinging arm which has its fulcrum fastened to the running board while its lower end is jointed and runs in a sleeve carried by the crosshead. Through a pivot, the motion of the arm is communicated to a sliding bar, which can be engaged with or disengaged from a second sliding bar by the spring catch. To put the indicator in operation the catch is thrown in and at the end of the stroke engages in a groove in the second bar, which then moves with the first bar, the indicator drum being worked by a cord attached to the former. A stop serves to throw out the catch and release the bar to which the cords are attached, thus stopping the drum. This apparatus was designed by Mr. Merry, a draughtsman in the service of the French State Railways, who also took all of the diagrams. A good deal depends on the skill of the operator, as there are at

*Abstract of articles by Mr. Joseph Nadal, Chief Assistant Engineer of Motive Power and Equipment, French State Rys., appearing in the Revue Generale des Chemins de Fer for May, 1903, and March, September, 1904. Translated by Lawford H. Fry.

least 17 movements to be made in taking each card. The length of time required for taking a card, from the placing of the paper to its removal, was from 15 to 20 seconds. The indicators were piped so that the boiler pressure, the steam-chest pressure and the atmospheric line could be marked on each card.

RESULTS.

Steam Consumption.—The dry steam consumption comprises three factors:

1. The steam consumption shown by the indicator diagrams.
2. The steam lost by cylinder condensation.
3. The steam lost by leaky piston or slide valves.

The indicated steam consumption (1) is given by the formula

$$m = V\left\{(a + e)\,g - (c + e)\,k\right\}$$

where m = weight of steam apparently admitted to the high pressure cylinder during each stroke.
V = volume of high pressure cylinder.
a = fraction of stroke at which cut-off occurs.
e = clearance volume as a fraction of the cylinder volume.
c = fraction of stroke at which compression begins.
g = the specific gravity of the steam at the point of cut-off.
k = the specific gravity of the steam when compression begins.

The amount of steam condensed at each stroke (2) is given by the formula developed by Mr. Nadal.

$$n = V\left(S + \frac{c\,\pi\,d\,s}{2}\right)\frac{l\,T}{r}$$ where

n = weight of steam condensed per stroke.
V = cylinder volume.
S = surface of the clearance space of the high pressure cylinder.
c = fraction of stroke at which cut-off occurs.
d = cylinder diameter.
s = stroke.
T = difference between the temperature of the steam at admission and that at exhaust.
r = latent heat at the admission pressure.
l = the coefficient of condensation.

This coefficient of condensation for a locomotive is $l = \frac{k}{\sqrt{n}}$ where n is the number of revolutions per second and K a coefficient which is dependent on the amount of expansion. The following table gives the values of K in metric and inch-foot-pound terms for various points of cut-off.

Cut-off in per cent. of stroke.	K	
	Metric.	In.-ft.-lbs.
20 per cent.	0.62	0.0044
30 " "	0.72	0.0051
40 " "	0.78	0.0055
50 " "	0.83	0.0059
60 " "	0.87	0.0062
70 " "	0.90	0.0064

The figures obtained from the tests show that the steam consumption per horse-power hour, for a constant working pressure, does not vary greatly when the cut-off and speed change for points of cut-off between 40 and 60 per cent. and speeds between 25 and 60 miles an hour. The steam consumption is, however, very sensitive to a change of pressure. For pressures of 200 to 213 pounds per sq. in. the steam consumption is from 19 to 20.7 pounds per horse-power hour. For pressures of 160 to 170 pounds the engine uses 21 to 22 pounds per hour, for 130 pounds per sq. in. 23 to 24 pounds per hour, while for pressures of from 100 to 115 pounds per inch the steam consumption rises to 25 or 26.5 pounds per hour.

Form of the Expansion Curve.—Of the three factors mentioned above as making up the dry steam consumption, the first two are given by the two preceding formulæ. The third factor, that is, the amount of steam lost by leakage at the slide valve can be determined by examining the expansion line of the indicator diagrams. The weight of steam apparently present in the cylinder at a given time is found by taking the point on the diagram corresponding to the given time and multiplying the corresponding cylinder and clearance volume by the density of the steam for the indicated pressure. If this is done for successive points along the expansion line of a normal diagram a slight increase in the weight of steam present will be observed. This increase is due to the fact that the normal expansion curve is nearer a hyperbolic than an adiabatic curve. Some of the steam condensed during admission is re-evaporated during expansion, thus increasing the weight of steam in the cylinder. A large increase in the weight of steam may be due either to excessive moisture in the steam during admission, so that the amount of water introduced into the cylinder and re-evaporated during expansion is abnormally large, or to leakage at the slide valve admitting steam to the cylinder after cut-off is supposed to have taken place. With these considerations in mind the diagrams obtained from the engines under test were examined. The cards from engine 2,617, which has the Bonnefond trip valve gear, show a slight increase in the weight of steam in the front end of the cylinder and a barely perceptible increase in the rear end. The flat slide valves which admit the steam and the piston valves which control the exhaust were steam tight.

For engine 2,754, fitted with Ricour piston valves, the cards show in the front end of the cylinder a slight increase in the weight of the steam, this increase being in nearly all cases less than 0.022 pounds. In the rear end the increase is never large and in some cases the amount of steam appears to diminish during expansion. This difference between the two cylinder ends may be due to one of two causes. It may be that, contrary to the assumption made in the calculations, the clearance space is not the same at both ends; or it may be that the more exposed position of the front end gives greater condensation during admission and a consequently greater re-evaporation during expansion. If the expansion curve followed exactly the hyperbolic law $pv = constant$, the increase in the weight of steam during expansion would average from about 0.009 to 0.011 pounds. This figure is very nearly the average of the increase at both ends of the cylinder. The results obtained from these two engines are exactly similar and appear to establish the form the expansion line should take when the valves do not leak.

On engine 2,802, Vauclain compound, the increase in the weight of steam during expansion is less than 0.022 pounds in the high pressure, and from 0.022 to 0.044 pounds in the low pressure cylinder. This increase is the same as was observed with the other types of engines with steam tight valves and is therefore not due to a leaky valve. The Vauclain piston valve is thus shown to be steam tight, at least during expansion, and it is during this period that any leakage is the most likely to occur.

The average of 30 cards taken on engine 3,729, de Glehn compound, shows that in the high pressure cylinder the weight of steam apparently present in the cylinder is slightly reduced during expansion. That is to say, the expansion curve is between the hyperbolic and the adiabatic curves, showing the steam has very little moisture on admission. The low pressure cylinders show a large increase in the amount of steam in the cylinder, but this is probably due to indicator faults caused by the pipe from the low pressure cylinder being too long.

The diagrams for engine 2,901, American piston valve, show an increase during expansion of about 0.055 pounds of steam, which is about three times the normal increase as observed for engines 2,617 and 2,754. As previously remarked, an abnormally large increase such as this may be due to priming, to too long an indicator connection, or to leaky slide valves. In the present case the two first causes need not be considered, as firstly the calculated steam consumption is within a few per cent. of the actual water consumption, consequently the steam cannot carry much moisture, and, secondly, the indicator piping was very nearly as short and as direct as that on engines 2,617 and 2,754. Therefore the only remaining explanation is that the slide valves were not steam tight, but admitted live steam during the expansion when cut-off should have taken place. The diagrams show that the leakage diminished as the expansion progressed and stopped before the exhaust opened. As there is no direct leakage to the exhaust the loss of steam is not large, and in the case under consideration amounted to about 6 per cent. of the steam used, or 1.76 pounds of water per horse-power hour. In calculating the apparent or indicated steam consumption for purposes of the tests, this loss of steam by leakage is taken into account by taking a point near the center of the expansion curve for the calculation of the weight of steam used.

(To be continued.)

Caring for Trestles While Being Filled.

A report on this subject was made at the Chicago meeting of the Association of Railway Superintendents of Bridges and Buildings. The committee sent out to members a list of questions and some of the replies received were as follows:

Northern Pacific.—The report describes the filling of a pile trestle 2,000 ft. long across a lake, which was filled from the bridge by a work train, the water being about 12 ft. deep and the top of tie about 6 ft. above the water. In filling, some of these piles were crowded out from under the caps but not enough to materially affect the safety of the structure. Another fill was a trestle 80 ft. high and 1,500 ft. long, with frame bents set on pile foundations. In filling this trestle a temporary track was laid on each side of the bridge and the filling carried up to within 20 ft. of the top of the bridge, both sides being carried up as evenly as possible. It was then allowed to stand for about two years, when the balance was filled up with the work train dumping from the top of bridge. On account of the care taken in filling no difficulty was experienced by reason of vertical pressure on the horizontal timbers or lateral crowding against the vertical timbers during the process of filling. In both cases the ties and stringers were removed as soon as possible after the filling was completed, as the filling at that time had a tendency (which could be depended upon to occur in general practice), to crowd the bridge out of line; also the settling affected the surface and it was considered easier to keep the track in a good condition on the dump than it would be with the stringers in.

It has never been found necessary to reinforce bridges before commencing to fill as this work had been started before the bridges became weak enough to call for anything of

this kind. In general, stringers, ties, and guard rails should be removed and in carrying up the filling, it should be kept as nearly uniform in height as possible. If stringers in filled-in bridges are not removed until near the approach of winter, as a rule they should be left in until next season. The filling would not have a chance to settle and after the ground was frozen it would be difficult to keep the track in good surface and line if the stringers had been removed. The material used makes a difference in filling bridges. Heavy clay, which forms into lumps, does not settle and pack as closely as gravel, slag, or sandy material.

A roadmaster on this same road writes: "When filling a trestle of more than one deck, material collects on caps and other horizontal timbers and causes them to break under this pressure, and often the filling material falls upon these timbers, breaking them. The vertical pressure bends and breaks these timbers on account of material settling away from and under them. Lateral pressure seldom occurs against horizontal timbers that would cause damage or displacement. Lateral pressure is caused by slipping and sliding of the material rolling down the slopes, and its force is directed mainly against the plumb and batter posts. All posts are affected by the material slipping longitudinally or in the direction of the track where the slopes usually incline from 25 to 65 deg. If a pile trestle, single deck, with piling reasonably sound, is to be filled, no precautions are needed unless the piles are 35 ft. long and over, or with steep slopes. Extra longitudinal, and perhaps lateral, bracing is required. The usual practice is to brace, strengthen, and replace inferior timber before starting to fill; also to watch carefully during the work and rectify weak places as they show up and make such changes as may be necessary to carry work along safely. In cases of trestles of more than single deck it is a good plan to fill out to the foot of the slope by scraping with teams, and on the balance to use a steam shovel and dump cars. If double deck bridges are to be filled they should all be filled from on top. It will be necessary to strengthen the middle caps and braces, using care to overcome any injury due to slipping. The fill should be made loose, as much as possible filling the lowest places first; work should not all be done from one end. Caps and all bent timbers should remain in the fill. If the fill is made with good gravel or furnace slag the stringers may be taken out with perfect safety when the weather is favorable and on the approach of winter, provided there is gravel on hand to surface and raise the track. Settlement of material should be allowed before removing timbers.

Southern.—This road prepares broad, substantial foundations for bents before commencing to fill, and if more than 15 ft. high they put in additional longitudinal struts about half the distance from ground to top of bent and allow it to remain until it has to be removed to make room for workmen to pass. If the trestle is over 20 ft. high they place these struts at intervals of 10 ft. This contemplates filling from below with teams where practicable. They begin in the lowest place and fill in so as to keep the filling at uniform height at all times, except where the trestle is located on a hillside, in which case they use extreme caution to keep the filling on the lower side at all times a little higher than on the upper side. It is important that the base of the fill be started at a proper width and kept approximately at the same height, except that it is an advantage to keep the outer edges a little higher, the object being to keep the weight of the filling inclining towards the center. Retention of the moisture would also assist in the settling of the filling matter, assuming it to be earth. Timbers are removed after the spring rains, and all bents put in good repair to last, at least for two years before filling. This they think gives time for fills to settle before removing timbers, and they find it necessary to add to the original filling frequently before timbers are removed.

Bessemer & Lake Erie.—On this road trestles have been filled until this practice is necessarily near its finish. This filling has been done usually with a center plow and both sides were brought up uniformly, keeping the dirt at about the same height on both sides. No trouble has been occasioned by pressure in any direction. They have not found it necessary to reinforce trestles unless they should be practically unsafe before commencing to fill, and that condition is not allowed to obtain. Timber above the caps is all that is removed. It is considered unsafe to remove stringers from filled-in bridges in the fall, unless there is ample time for the filling to become solid before winter sets in. They find that the time required for a fill to settle depends very largely upon the nature of the material used. They recently filled a 3,000-ft. trestle with slag where the settlement was scarcely perceptible, but where clay was used they find it takes longer to settle. But in all cases their experience has been that there is less trouble in maintenance where fills have had ample time to settle before trains are run over them.

Union Pacific & Oregon Short Line.—These roads have a great deal of this work to do, especially in the mountain districts, but as a rule the openings have been neither high nor long; yardage was therefore small and the character of the earth generally dry and firm so that chances for accidents were correspondingly reduced. During the time of the writer's connection with the B. and B. department of the Union Pacific on the Wyoming division we had over 200 bridge openings filled over pipe culverts, concrete, stone, or some other form of permanent water way; and during this period, extending over a term of about 20 years, and subsequently over four years with the Oregon Short Line, no accident, however slight, has ever marked the progress of this work. The class of work which has proved most difficult in the line of trestle maintenance, during filling, is that which is built for the purpose of grade construction; however, in this case only small dump cars and engines, used by contractors, are engaged on the work, and this feature of it is generally cared for by the grading contractor. Filling in is done as a rule from one end, and fresh filling, constantly shifting, makes it most difficult to retain bents in serviceable condition.

The committee offered the following conclusions: In high fills of timber trestles, breakages of horizontal timbers are unavoidable, as they are not supported except at bearings. Points where posts are not in direct contact with sills and caps are also subject to the same conditions, and will also give way under added tons of filling material, so that under a heavy fill it is safe to assume that the posts and portions of longitudinal timbers, with the actual bearings of caps and sills in this vertical line of posts, are the only timbers not distorted and rendered worthless by the weight and settling of material in the fill. Therefore it should be borne in mind that the vertical timbers and, more strictly speaking, the plumb posts, are the only supporting timbers unaffected by the pressure of the fills, as batter posts are affected in proportion to their inclination from a vertical line. To insure stability in the structure during filling the best practice is to cut off all horizontal timbers when filling reaches a height so that they can be eliminated, as they would then be of no value in sustaining a vertical position of the bents, which (if filling is carried up evenly) would be insured by the filling matter all around the bent, and their use would only tend to throw the sill of the next bent above from its natural bearing. These timbers need not be removed until the dirt in the fill reaches them, when the necessity for their use no longer exists and their presence in their natural position would be a serious detriment to the structure, as it would be, in the fill.

(2) The precaution of getting supporting posts in a vertical line before filling is a necessary one, and more especially in the heavier fills, as the filling of trestles (say 20 ft. high or less, single deck) is much simpler since the trestle is sufficiently rigid to carry trains. The trestle is able to resist any pressure that could be exerted against it in filling, and a pile bent has the advantage of having no surface exposed to vertical pressure, which would be the reverse where frame bents are used, supported by blocking. In the latter case the bearing surface would be increased where the ground is yielding and the tendency to settle would be increased accordingly.

(3) The best results are obtained by carrying up the filling on a level, and in this way preventing the slipping of the filling, which would result in a lateral pressure and consequent displacing of bents or breaking of vertical timbers. Should this method of filling for any reason not be practical or expedient, the trestle would be kept in better position by taking off sway-braces, which would tend to obstruct the natural settlement of the filling. The least resistance presented by the structure to the natural movement of the filling material will give best results in maintaining the trestle during the filling period.

(4) The general practice is to remove bridge ties, stringers, and guard rail, leaving in the caps to rot out in the fill.

(5) Filling must be done when the frost is out of the ground, and should also be done when the dirt is dry and not in a rainy season. If a general, absolute rule is to be laid down, the best time is during summer months and not so close to the freezing-up season as to have any great amount of settlement occur. After that time, however, in low fills where the settling is slight, there is some advantage in getting timbers out, as they can catch fire and cause possible trouble. If they break, there is no chance to detect it until it could be observed in the surface of the track, and it is our experience that such a filled-in bridge is not as easy to hold in surface and line as when the track is on the dump.

(6) It is found that where practicable it is an economical plan to grade in as much by team and scraper from below as can be conveniently reached. Such filling is pretty well packed as it is made, and this appears to be the usual practice, but in high fills it is of course necessary to fill in the greater bulk of it from on top.

The general trend is, and has been for some time, towards the elimination of the timber trestle, in main line bridges particularly, and the wisdom of such action is apparent. The committee is of the opinion that the ideal condition will be attained when the timber trestle will be eliminated entirely.

The report is signed by A. H. King, Chairman; J. B. Sheldon, H. D. Cleveland, A. J. Hart, F. Ingalls, J. S. Lemond.

Forest Park Bridge of the Wabash at St. Louis.

By A. O. CUNNINGHAM, *M. Am. Soc. C. E.**

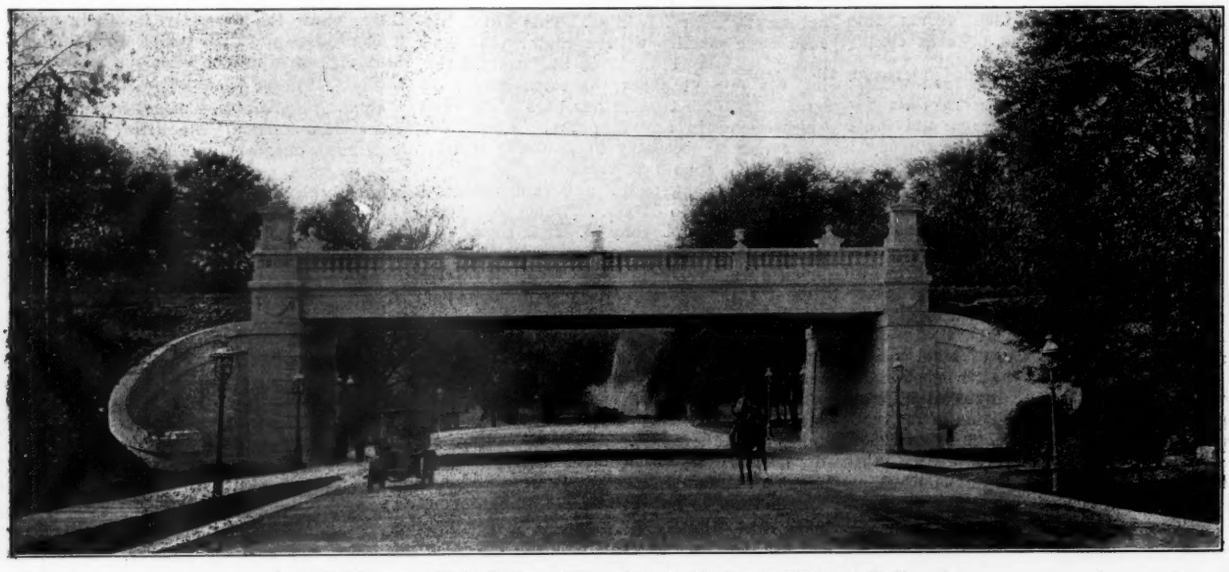
Bridge No. 11 on the Wabash Railroad is over the entrance of the main drive into Forest Park, St. Louis, and the old bridge which stood on this site and which was erected about 20 years ago had a clear span of only 40 ft. On account of the congestion in the roadway at this point and the consequent danger to pedestrians and vehicles in passing under the bridge, the city authorities requested the railroad company to put in a new bridge with a clear span of 70 ft. and to make it an ornamental structure in keeping with the surroundings. The city agreed to pay $15,000 towards the cost of the new bridge with the understanding that the plans should meet with the approval of the Board of Public Improvements. The railroad company accepted the suggestion and proposition of the city authorities and the writer was instructed to prepare plans for a suitable structure that would meet with their approval.

The natural design to adopt for this place would have been an arch, but on account of the limited head room, such a design was not suitable. There remained, therefore, but one way to make this an ornamental bridge, and that was to devise some plan for covering over the unsightly through plate girders necessarily used with a decorative exterior finish. On account of its cheapness and durability it was decided to use concrete for this purpose, and the accompanying illustration from a photograph of the nearly completed structure shows with what graceful and pleasing effect this was done. Ornamental bronze lamp posts are still to be placed at the foot of the abutment wing walls and bronze ornaments on the sides of the newel posts at the ends of the bridge.

The new plate girders put in were 80 ft. long, and it was necessary that they should be at least 8 ft. deep. The cost of the work was limited to $25,000, and while this seems a large amount for such a comparatively small structure, yet when the amount of work necessary to lengthen out the old span is taken into consideration, including a large amount of excavation behind the old abutments, carrying the track over this opening, keeping the banks from caving in, and the removal of the old span and abutments during the operation of trains, it will be seen that the cost was, after all, low. For the sake of economy it was decided to use concrete with reinforcing rods for the abutments, using the hollow type with buttresses. This design of abutment was brought out by the writer and first used for the bridge at Monticello, Ill., which was described in the *Railroad Gazette*, Jan. 8, 1904. Corrugated bars and Red Ring brand of cement were used, the proportions of the concrete being 1 cement, 2 sand and 5 stone.

Plans were approved by the Board of Public Improvements on March 25, last, but as arrangements for payments by the city were not then completed, work on the bridge was delayed until about April 20. The contract for all of the masonry work was let to the Geisel Construction Company, St. Louis, and the American Bridge Company received the contract for the steel work, which was erected in place by the railroad company's own forces. About 2,000 cu. yds. of earth were removed from behind the old abutments and the old abutments themselves which were also removed, contained about 580 cu. yds. of rock. As this material could not be taken away by work trains on account of traffic it was necessary to cart it away and dump it outside of the park limits.

The accompanying drawings show the principal details of the construction of the bridge and abutments. The wing walls of the abutments have the same hollow cross-section with buttresses as the face walls, and are carried down with a constant slope of 1½ to 1, but instead of being carried out, straight or with a flare, they are given a spiral curve forming a recess back of the line of the face wall and ending at the bottom with a simple pedestal for the ornamental lamp posts. The reinforcement in the wing walls consists of vertical and transverse horizontal rods. Three standard through plate girders spaced 15 ft. apart and resting on bearing plates set on the abutments, support the two lines of track. These girders have solid floors supported on 15-in. I-beam floorbeams spaced 18 in. apart. The floor consists of a layer of concrete 6 in. thick in a proportion of 1 cement, 2 sand and 4 stone, reinforced with longitudinal and transverse rods, and which rests directly on the floorbeams. On this is laid stone ballast to a depth of 14 in. and the ties are bedded



New Bridge over Main Drive of Forest Park, St. Louis, Wabash Railroad.

Lowering Girders on to False Work with Wrecking Cranes.

*Bridge Engineer, Wabash Railroad.

in the ballast in the usual way. This form of solid floor is standard on the Wabash.

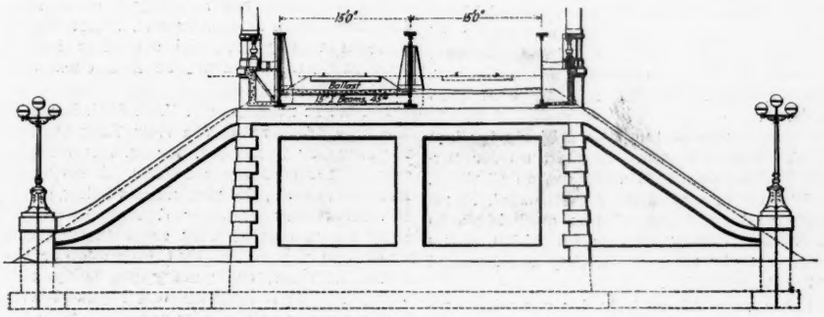
The ornamental balustrade along the sides of the bridge consists of a thin shell of concrete reinforced with longitudinal bars and supported on angle iron brackets attached to the stiffening angles on the girders. The lower part of the balustrade is paneled and ornamented only with simple cornices. It is 4 ft. 6 in. deep, 8 in. thick, and is spaced 3 ft. away from the web of the girder. Surmounting it is a row of concrete balusters 2 ft. high with a coping also of concrete running along the top. The under side of the opening between the ornamental shell and the girder is closed with a thin shell of concrete 4 in. thick, and the top is covered over with a wooden gutter paved with tar and gravel.

The dismantling of the old bridge and the erection of the new structure was a difficult job to carry through without interruption of traffic. It is on the main line of the Wabash between the Union Station and the World's Fair grounds, and all Wabash trains both to and from the East and West were sent over it. In addition to these regular trains, the shuttle trains to and from the Union Station and the Fair Grounds were scheduled to pass over it every 15 minutes each way, and the Rock Island also ran all of its passenger and freight trains into the city over this line. About 300 trains a day, in all, used these tracks.

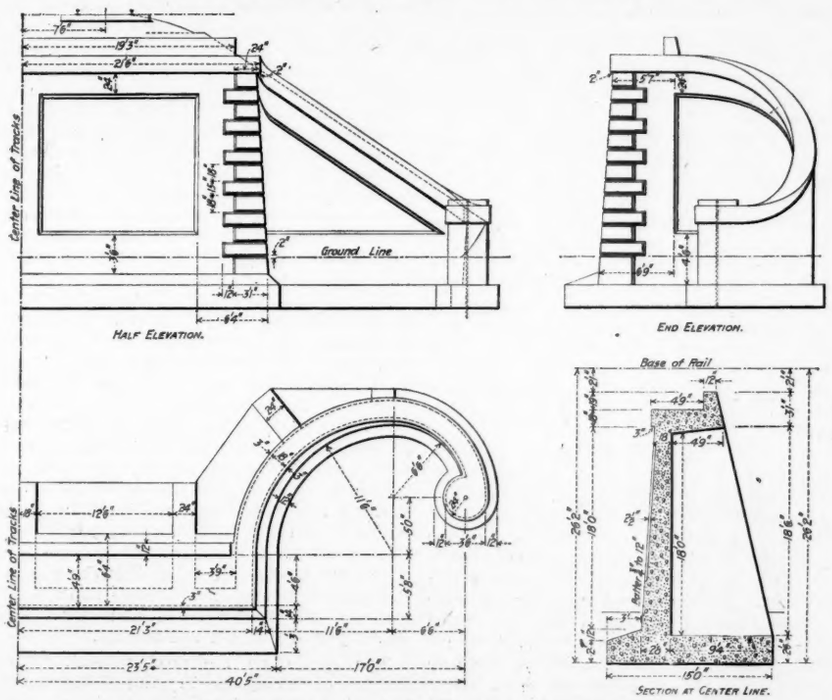
On account of the number of trains and the fact that the floor of the bridge was made of a reinforced concrete slab resting on I-beam floorbeams, it was decided to erect the bridge complete on one side of the existing structure. This was done on false work which consisted of a line of bents with a single cap under each end of the girders. The bents were erected between the old and new abutments and on the cap was laid a line of steel rails. The girders were unloaded from the cars by two wrecking cranes, one at each end and lowered on to the falsework. This was done on Sunday, when there were few trains to be delayed during the unloading. After all of the steel work had been unloaded it was jacked up and erected on the falsework by the railroad company's bridge gang. The concrete floor was then put in and allowed to set for two weeks, after which the ballast and ties were laid. The ornamental work was not put on until after the new girders were in place.

Because of the frequent service of the shuttle trains it was not possible to take out the old bridge and put the new one in on a week day, but as these trains did not run on Sunday it was decided to do the work on that day. The old structure was similar to the new bridge, being composed of three through plate girders, but having the tracks supported on floorbeams and stringers.

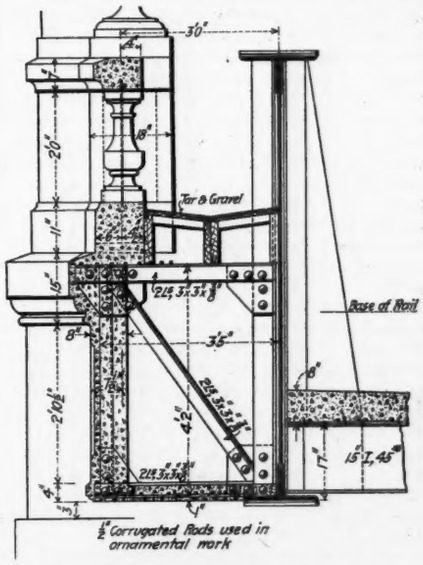
When all of the early inbound trains had crossed the bridge, the work of taking up the rails and ties on the inbound track was commenced at 9 a.m. The stringers and floorbeams under this track were then cut loose and by means of one wrecking crane at each end of the bridge, these parts carried back and deposited on the right-of-way. The outside girder was lifted up by the cranes and placed on two push cars standing on the adjacent track, and was pulled back out of the way. Then the new bridge, completely erected, was pulled over on the falsework, half way in place, so that the out-



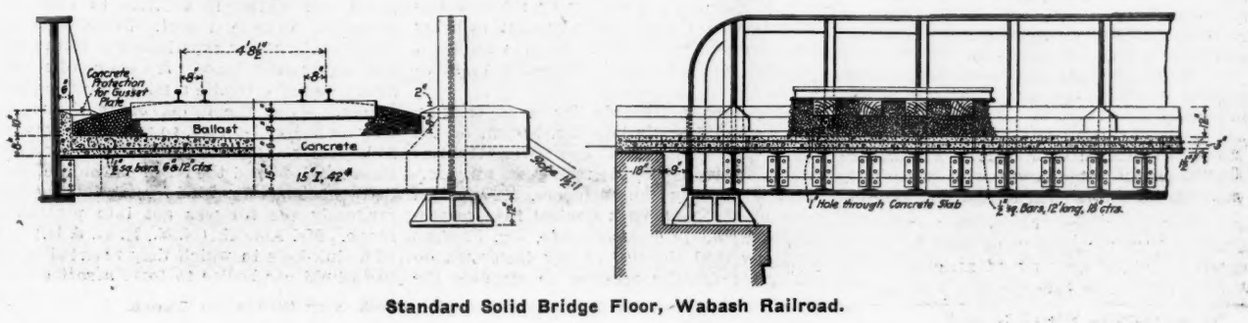
Section through Bridge and Elevation of Abutment.



Details of Concrete Abutments and Wing Walls.



Section through Girder and Balustrade.



Standard Solid Bridge Floor, Wabash Railroad.

bound track on the bridge was in line with the inbound track on the embankment. This was done by triple blocks and 1½-in. rope, attached to locomotives pulling back of the cranes. One triple block was fastened to a 12-in. x 12-in. vertical timber with one end buried in the ground and the other end resting against the coping of the abutment and projecting over the top about 2 ft., and the other block was attached to the girders. It was necessary to do the work in this way because the city authorities would allow no obstruction in the roadway, so that no falsework could be placed under the bridge. When the new girders were half-way in place the rails were laid down on the ballast and ties already in place and joined up with the inbound track on the embankment. As soon as the inbound track was connected up, the other half of the old bridge was cut apart and taken away by the wrecking cranes. The temporary connection of the new bridge was broken and the whole structure pulled into its permanent position. By six o'clock in the evening of the same day both tracks were connected over the new bridge and traffic resumed as usual. With this method of doing the work one track was always available, and the regular trains were handled without delay, there being crossovers immediately beyond each end of the bridge.

The total weight of the structure while being pulled into place was 230 tons; this included the weight of steel work, concrete floor, ballast and ties. As soon as the bridge was finally in place, work was commenced on the ornamental concrete sheathing.

Awards for the Pennsylvania at St. Louis.

The Pennsylvania has been awarded the World's Fair grand prize for its locomotive testing plant, engineering models and tunnel construction on exhibition in the transportation building at St. Louis, and also the grand prize in the department of liberal arts for the model of the New York terminal station. The company has also been awarded gold medals for its Y. M. C. A., pension relief and savings fund exhibits in the department of social economy. A gold medal has also been awarded to each of the following collaborators in the preparation of the Pennsylvania's exhibits: J. J. Turner, Third Vice-President, Pennsylvania lines; Theo. N. Ely, Chief of Motive Power, Pennsylvania Railroad system; F. D. Casanave, Special Agent; A. W. Gibbs, General Superintendent Motive Power, Pennsylvania Railroad Company; E. D. Nelson, Engineer of Tests; A. S. Vogt, Mechanical Engineer; G. L. Wall, Director of Tests; J. E. Sague, Professor W. F. M. Goss, E. M. Herr, F. H. Clark, F. M. Whyte, H. H. Vaughn, H. V. Wille, C. H. Quereau, Willard A. Smith, J. A. Aspinall, Karl Steinbiss, members and associate members of the Advisory Committee; Charles M. Jacobs, McKim, Mead & White, Klee Brothers, Victor Mindeleff and Professor G. I. Alden.

The proposal to double-track the Trans-Siberian Railway in order to increase its carrying capacity for troops and munitions of war has been abandoned as impracticable at this time because of the inevitable interruption of traffic which would occur on the present single track line. Plans are being made, however, for increasing the capacity next summer by utilizing the rivers in eastern Siberia, increasing the number of boats on them and building a second line through the country between the streams. This can be done with but little interruption of traffic, but the cost is sure to be great. The time required, however, would be short, and time is the essential consideration.

Superintendents of Bridges and Buildings.

The Association of Railway Superintendents of Bridges and Buildings held its fourteenth annual meeting in the Sherman House, Chicago, October 18, 19 and 20. It was called to order by President Montzheimer, Chief Engineer of the Elgin, Joliet & Eastern. After a prayer by Mr. J. H. Cummin, of the Long Island Railroad, Dr. Howard S. Taylor, representing the Mayor, delivered an address of welcome, which was responded to by Mr. Cummin. The President, in a brief address, reviewed the condition of the association during the past year. A booklet outlining the work and purpose of the association had been sent to the general managers of all railroads and had yielded good results in additions to the membership, which is now about 300.

The membership committee reported 86 applications for membership, a number of which came from Australia and New Zealand. All were admitted on vote of the association. The Treasurer reported a balance of $678 on hand.

According to custom, the subjects for last year's convention were brought up for further discussion. There were nine of these, and with the exception of the second, in regard to the gaining of ties on bridges to leave rail without camber, on which a few brief remarks were made, they were passed without discussion.

There were 12 subjects for committee report this year and two individual papers. The first report for discussion was on the best form of traveler to use in erecting steel railroad bridge spans up to 200 ft. The report, with the exception of a number of letters read to the convention by the chairman, is reproduced practically in full in another column.

Mr. R. H. Reid (L. S. & M. S.) said they use steam wrecking derrick cars of 40 to 60 tons capacity, which will handle all ordinary work. They can place girders up to 103 ft. in about a half hour. This was considered the cheapest and most economical method since the derricks belong to the motive power department and the B. & B. department is therefore at no expense on their account except when actually using them. The cost of the derrick, locomotive service and their crews is $2 per ton of metal erected. The total cost for all girder construction erected by these derricks never exceeds $5 per ton.

Mr. W. O. Eggleston (Erie) does not use chains for lifting heavy loads in bridge work, using stirrups with 1¾ or 2-in. rods instead.

Mr. Steffens (N. Y. C. & H. R.) explained methods employed on his road. In one case a number of 116-ft. span, 78-ton plate girders were put in on the West Shore by steam derricks. They replaced old Phœnix truss column spans, the latter being dismantled by a traveler of two or three bents. A unique method will be used on the Pennsylvania division, over the Susquehanna river, where five half-through spans will be replaced with deck girder construction. To eliminate the cost of falsework a trolley or traveler has been devised, the method of operation being described by the speaker. He was confident the cost would be small compared to falsework.

Asked about methods for steel trestles, one method described by Mr. Smith, of the committee, employs a cantilever traveler with a trolley boom, the trolley running forward to convey the members. A method used by the New York Central in a treacherous stream in Pennsylvania, Mr. Steffens said, involved the use of low falsework on each side for the traveler to straddle the structure.

There was no printed report on subject No. 2: "What has been the experience in the use of concrete under bridge bed plates and turntables in place of pedestal stones, and what is the best form and material for bed plates under various styles of iron bridges?" The subject was taken up for discussion by the convention and later a brief written report was received from the chairman of the committee, Mr. C. F. Loweth (C., M. & St. P.). This report testified to the good results that the writer had observed and experienced with concrete in two applications referred to. Some 100-ft. spans were mentioned, the seats for which had been in four years and no wear was observable. Turntable centers on which the load had been placed 18 hours after setting had been in service two years without any sign of deterioration. According to the writer's experience, concrete was in every way as suitable for bridge seats as stone, if not better, since it will permit the use of a higher unit pressure. It must be first class concrete, however.

Mr. W. F. Steffens (N. Y. C. & H. R.) said the unit pressure on the New York Central for masonry is 250 lbs. per sq. in.; for concrete it has been made 200 lbs. A very rich mixture is used, the proportions being 1:1:2. Mr. Alexander (Bangor & Aroostook) related an experience with concrete turntable walls and foundation that failed under the action of frost, the quality not being rich enough. The foundation was replaced with a heavier one, which was cross-laid with old rails bedded in the concrete, forming a grillage.

On the Lake Shore Mr. Reid said the proportions are 1 part of cement, 3 of gravel and 6 of crushed limestone. They get a very hard concrete, that will stand severe shocks, being much less brittle than limestone. Speaking of the hardness of concrete, Mr. Killam (Intercolonial) told of an instance where it took two men two days to put a hole 14 in. deep in a certain piece of concrete masonry on their road. He spoke of the deterious effect of sea water on concrete in their harbor works, and other members testified to the same effect.

Mr. Steffens described a method they have for winter work, which consists in making the forms double, with a 6-in. space between, the latter being packed with manure. They have never had a case of frosted concrete. They heat their materials.

Questions having been asked about the cost of concrete for bridge seats, Mr. Bailey gave $7 a yard. Mr. Killam said an item so small cannot be accurately computed as there are variable factors affecting it. With them the figure is $6 to $7 a yard. They use White Bros. cement, an English brand.

The consensus of opinion brought out by the discussion was that concrete was a good material for bridge seats and turntables where properly mixed and applied.

The report on the next subject, "Best Method of Caring for Trestles While Being Filled," is printed in abstract in another column. The discussion did not develop much new matter in addition to what was presented in the report. Some members related interesting experiences in filling trestles across sink holes. A case on the Lake Shore was of a trestle a mile long through a marsh. When the filling began the trestle became badly distorted, so much so that after filling as rapidly as possible the stringers were removed and the track put on the bank. Settlement was provided for continually until gradually the fill was got into permanent shape. Mr. Aldrich (N. Y., N. H. & H.) told of a sink hole in which they resorted to the use of old car bodies to form a sort of pontoon or grillage for the fill. A temporary

track was built to carry the road around the point while the filling was being done, the temporary track being about 150 ft. away. The weight of the fill forced the mud up on both sides almost level with the track and it began to displace the temporary track. The fill was finally brought to a condition of permanency. Mr. Alexander filled a trestle on an 8-deg. curve, keeping the material wet down as filling progressed. He took out the stringers as soon as the filling was completed and found no trouble in keeping the track in surface. He thought it good practice to wet the work down whenever practicable as otherwise the fill will continue to settle for quite a while. Mr. Reid told of filling a trestle on the Lake Shore, 75 or 80 ft. high. Before beginning work it was braced in every way possible. The filling was done at the rate of 75 to 100 cars a day, men below spreading the material in order to progress uniformly. Yet despite all precautions as the filling rose the bracing was crowded off.

The next report considered was, "Steam Hammers vs. Drop Hammers for Pile Drivers," extracts from which are given elsewhere. Supplementing his statements in the minority report, Mr. Reid said that after the experience related with the steam hammer they substituted a 4,500-lb. drop hammer which did the work with entire satisfaction.

Mr. Carpenter (Southern) thought that for road work the steam hammer is not as suitable as the drop hammer. He related an instance from his own experience where he had to drive 60-ft. piles on the inside of a 5-deg. curve, 14 ft. from the center of the track, with 30-ft. piles on top of them for a temporary tank. He was able to do the work quite satisfactorily with a drop hammer, but did not think it would have been possible with a steam hammer. Mr. Reid has driven 2-in. pine sheet piling with a 3,200-lb. drop using a short light blow, without splitting or seriously injuring the piling. Most of the members appeared to have used the drop hammer and the testimony was therefore largely favorable to it for track work.

Mr. Penwell (L. E. & W.) told of a case where he was able to observe a steam and a drop hammer working in competition. A washout occurred on a piece of track in which his line and the Pennsylvania were jointly interested. Both set to work on the repairing, the Pennsylvania using a steam hammer on one end and his road a drop hammer on the other. The steam crew seemed to be able to set their piles quicker and drive straighter but after starting they could not drive as fast or as far. However, in his opinion, for ordinary bridge work the steam hammer is preferable.

Mr. Killam said his specifications state that driving shall stop when the pile only goes 1 in. under a 25-ft. fall of a 2,200-lb. ram. Mr. W. H. Finley (C. & N. W.) said that the action of the pile depends on the nature of the soil and therefore specifying the amount of penetration for the last blow is not a safe guide. He related an instance of some piles that moved 8 in. at the final blow, yet in 48 hrs. in trying to drive them enough deeper to put on an additional cap, they were moved only with the greatest difficulty. In another case they drove 800 piles in quicksand and each one had to be given 500 blows, the penetration being as great for the first as the last blow. One was withdrawn to see if it had not been shattered by the pounding, but was intact. In his opinion the steam hammer is preferable, giving quicker and better results and being more scientific.

Subject No. 9 was "Best Record Forms for Buildings, Water Tanks, Etc." The committee obtained a supply of the record blanks used on the Chicago & North Western, and distributed them among the members, asking opinions and criticisms. The report is made up of the replies of those members suggesting changes in the blanks. In addition to the Chicago & North Western blanks the report submits copies of blanks from the Michigan Central, Minneapolis & St. Louis, Colorado & Southern, Rock Island and Lake Erie & Western. The report is signed by B. J. Sweatt, Chairman; B. F. Pickering, A. Shane, I. O. Walker, I. F. White, William E. Harwig.

There was no discussion of the report.

At the beginning of the Wednesday morning session the report on "Best Freight and Roundhouse Doors and Fittings for Same" was taken up. The report was brief. It stated that the freight house door in common use is the wooden panel door, moving horizontally, hung by two wheels to a track on the wall. Brief mention of vertically-moved doors was made and their advantages stated. The wood-panel square-top door with as little glass as possible is recommended for roundhouses. There should be clearance at the bottom to avoid springing from crowding over snow and ice and heaved track in winter. An acceptable method of fastening is mentioned. The report is signed by John I. Banks, Chairman; J. McIntyre, R. K. Ross, E. M. Gilchrist, G. W. Walker.

Mr. J. P. Snow (Boston & Maine) sent a written discussion. Where the platform must be enclosed and the side of the house is therefore close to the track there is often difficulty in spotting the cars opposite the doors. The posts also usually interfere. They are using an arrangement based on the scheme described by Mr. A. S. Markley (C. & E. I.) before the Maintenance of Way Association last spring. The B. & M. terminal freight houses are built of wood, with wooden side posts set 6 to 8 ft. in from the side of the building. The roof trusses overhang these posts, carrying the side walls and doors. The doors are hung on two parallel tracks to be run by each other and also to be run apart to provide large openings. At water terminals where freight sheds must accommodate vessels, teams and cars, the door problem is complicated. On the water side the doors must be 16 to 20 ft. high and continuous. It is best to hang them outside of the posts, though there must be a fender platform outside, not over 2 ft. wide. Doors for admitting teams to the sheds must be large (14 ft. high x 16 ft. wide). An inexpensive and fairly convenient method of opening the door is to have it in halves and to hinge it strongly at the top. Then slide the lower half part by counterweights up inside the upper half and hitch by a crotch hitch to the lower corners of the latter and haul it up to a horizontal position. For sliding-door hangers the essential features are strength, simplicity and impossibility of getting off the track. Roundhouse doors should swing in and there should be provision for holding them open. Usually the doors and posts of roundhouses occupy, when standing open, about 18 in. of width, which is waste room. The Boston & Maine reduces this to 10 in., thereby saving about 5½ per cent. of the size of the building. The posts are made of Z-bars and the doors are hung by three hinges on angle-iron lugs.

Some members having indorsed patented makes of doors, Mr. A. Shane (T., St. L. & K. C.) said the objection to these doors was their high cost. He claimed he could make doors, which can be cheaply maintained, at 25 per cent. of the cost of patented doors.

Mr. H. Rettinghouse (C. & N. W.) said a committee on the Chicago & North Western had discussed the door question in an effort to learn if there was not something in the way of material and manner of construction that is superior to the present wooden nailed doors. They had in mind an iron door with a frame of angles and a body of sheet metal. They made inquiries of users of steel rolling doors regarding their action in cold weather. Some replies were favorable and others adverse, the latter stating that for roundhouse use the gases affected them. The cost of an iron door such as mentioned above would be $50 for black iron and $60 for galvanized. An estimate on a wooden door furnished them was slightly under $80, of which $38 was for material and the balance for labor.

Mr. A. S. Markley (C. & E. I.) said they had abandoned the round top roundhouse door as the upper hinge had to be placed so low that warping and distortion were assisted thereby. Mr. G. W. Andrews (B. & O.) said it was hard to build large doors without wind and almost impossible to fasten them with the ordinary bolt. He described a method he used of having a rod run up the inside of one door and a simple arrangement of lever and hooks for forcing the other door to place.

Mr. Killam said the Intercolonial had abandoned the round top door and the windows in the door. The latter are placed above the doors, which are square topped. They have no trouble keeping these doors tight.

On the Duluth, Missabe & Northern, Mr. W. A. McGonagle said that on account of trouble from snow and ice they stop their roundhouse doors about 10 in. from the ground and place below them a timber notched over the track, which is separate from the door. On the Lake Shore they use a somewhat similar scheme. A plank is hinged to the bottom of the door and when the door is to be opened the plank is folded upward.

The report on "Best Method for Preserving Timber and Piles in Structures" was next considered. The report states the advantages of timber preservation and describes the different methods. It quotes Dr. Herman von Schrenk's statement of conditions to which the ideal preservative should conform, which is found in Bulletin No. 14, U. S. Department of Agriculture. An appendix contains the specifications of the U. S. Government and of the Bell Telephone Company for creosoting southern yellow pine; the specifications of the Norfolk Creosoting Company for creosoting timber; and some statistical information. The report is signed by W. F. Steffens and C. C. Witt.

In presenting the report Mr. Steffens read some letters for the purpose of showing that of the great amount of timber track structures on railroads in this country, the number containing treated timber is extremely small. He stated that the structural aspect of this question has not been as largely dealt with as some others. Impregnation by crude petroleum is in the experimental stage and is not far advanced. He thought it inadvisable from the structural standpoint, because it increases the inflammability of the timber. Replying to a question of Mr. Reid, regarding the strength of creosoted yellow pine sap wood which beforehand has little strength, he said that tests by the Bureau of Forestry had showed an increase of strength, though the results were not regarded as conclusive and are to be carried further. The discussion of the subject by members developed nothing new.

Subject No. 12 was "Best Method of Protecting Low Overhead Structures Over Tracks from Gases and Blasts of Locomotives." Extracts from the report are printed elsewhere.

Mr. Steffens stated that they had had an experience similar to that related by Mr. Aldrich in the report, where the cement and expanded metal protection had dropped off. He asked about the practice followed by the city of Columbus, Ohio, namely, that of using

⅞-in. wooden sheathing. Mr. Reid said this was used in Buffalo, and although it protects from the cinders and the blast action, he did not think it protected fully against gases and steam.

Mr. Steffens reported that they think they have at last found the ideal protection. It is a coating which is a neutral pitch, and is a patented process. Tests have shown it to be acid proof and proof against temperature changes. It had also withstood tests against brine and caustic soda.

"Best Forms of Construction of Engine Houses" was next discussed. The report opens with a presentation of the advantages and disadvantages of rectangular engine houses and quotes rather fully from the paper by Mr. George P. Nichols on this subject, read before the Western Railway Club last February. Some rectangular houses are being built by the Pere Marquette and the transfer tables are described as follows: "The transfer table is designed with several special features, the end in view being absolute reliability and rapidity of service. The table is equipped with two motors with series-parallel controllers, the same as in use upon modern street cars, and in addition to the motor equipment an auxiliary gasoline engine has been provided, complete with air starter, for use in case of accident to the power plant or at times when the power plant could be closed down to advantage. The transfer table has a capacity of 175 tons, and will operate with a speed ranging from 200 to 800 f.p.m. when run by the two 25-h.p. motors. When operated by the gasoline engine it operates at about one-half normal speed. Rolling wood shutters are used for all the track doors opening on the transfer table."

A circular letter was sent to members asking questions and requesting drawings. Among the latter is one from the Gulf, Colorado & Santa Fe showing plans for a house to be used in southern Texas. It is exceptionally high, being 18 ft. at the side next to the turntable, 31 ft. on the opposite side, and 38 ft. at apex of roof. It is provided with a continuous louvre placed at the apex of roof and extending clear around the house. This takes the place of smoke-jacks, none of these being used. The slope of the main roof is ⅜ in. in 12 in. and the extra height is obtained by two vertical raises of about 5 ft. each; windows are provided at each of these points. The outside wall is pierced with windows clear to the roof. This plan results in exceptionally good light and ventilation.

Some of the replies to the circular letter are given in an appendix to the report. The report is signed by A. W. Merrick, Chairman; L. H. Wheaton, R. L. Hefflin, C. W. Kelley, C. C. Mallard, A. B. Manning.

Mr. Andrews (B. & O.) thought that all roundhouses should be on concrete foundations, have vitrified brick floors, a pit for every stall and a drop pit for every 10 stalls. Their roundhouses have all piping overhead and are equipped with a blow-off system, which quickly pays for itself they find. The stalls in the newest houses on the B. & O. are 90 ft. and at the rear of the pits is a lorry track for conveying locomotive parts. Telescoping swinging smoke-jacks are used. Referring to the rectangular design, he thought engines could be got out of the circular house much easier and quicker and that the circular house should be more economical of operation. Mr. Schall (Lehigh Valley) said he had built a rectangular house in 1884 which had a yard on each side and it proved expensive to operate.

There was no printed report on "Best Methods of Filling Ice Houses and Conveying Ice to Refrigerator Cars." A brief written report was submitted in which the committee expressed the opinion that for filling houses of 1,000 tons or less, horse power combined with hand labor is the most economical for lifting or elevating the ice. Above this, power should be used, an endless chain conveyor being the suggested method, where the source of supply is nearby or where the ice is taken from cars. To ice refrigerator cars, elevated platforms and dumping through the roof seem to be the most suitable means. Where crushed ice is used, the best practice is to have hopper "buggies" and elevated platforms, the ice being discharged from the buggy into the car.

Some description of methods in use by different roads and packing companies was brought out in the discussion. Mr. Shane (T., St. L. & W.) said they expected to put up a 25,000-ton icing station, and he saw no reason why some arrangement could not be devised by which a train of cars could be iced as quickly as a few cars. An idea that had occurred to him was to have a long elevated platform with pockets, which could be filled with crushed ice upon notification, before the arrival of the train. A member suggested that the pockets would have to be movable to provide for cars of different lengths and designs.

The written report on "Best Methods of Filling Track Water-Tanks Automatically" was brief. The committee thought that the pumping should be either by steam or gasoline engines, though the former is preferable, as it furnishes steam for heating the tanks in cold weather, and also where there is a roadside tank, one pumper can serve both. The water should pass from the roadside tank to the track tank by gravity, and feed pipes should be spaced 300 ft. apart to insure uniform filling. The supply should be regulated by a float valve in an auxiliary tank at one side.

Mr. Reid said the Lake Shore does not use the automatic cut-off and supply valve. They employ a "maintainer" who attends to the filling and removes from the tank the foreign matter that falls into it, and which would interfere with the action of the scoop. The automatic valve is too slow where trains are frequent. Mr. Steffens (N. Y. C. & H. R.) said they have the automatic valve in use at Croton, one of their busiest points, and it gives entire satisfaction, permitting the tank to fill in two minutes.

Two individual papers were presented during the convention. One was on "Cleanliness of Station Grounds and Buildings" by Mr. J. H. Markley (T. P. & W.). He suggested methods by which with the exercise of some care and watchfulness, right-of-way, yards, station grounds, buildings, etc., may be kept much cleaner and more presentable looking than is usually the case.

The other paper was entitled "The Evolution of Railroad Bridge Building," by Mr. W. H. Finley, Principal Assistant Engineer of the Chicago & North Western.

The subjects for next year are: 1. Construction and maintenance of docks and wharves. 2. Relative value of concrete and timber piles. 3. Concrete building construction, including platforms. 4. Anchors for plows and derricks. 5. Methods of repairing roofs of various kinds. 6. Methods of watering stock in transit. 7. Protection of water tanks and water pipes.

For the first time in its history the association will have standing committees, the subjects being as follows: 1. Pile and framed trestle bridges. 2. Steel bridges. 3. Buildings. 4. Docks and wharves. 5. Water supply. 6. Fire protection. 7. Fences, crossings and cattle-guards. 8. Preservatives for wood and metal. 9. Coaling stations and cinder pits. 10. Records and accounts.

The officers for the ensuing year are: President, C. A. Lichty (C. & N. W.); First Vice-President, J. B. Sheldon (N. Y., N. H. & H.); Second Vice-President, J. H. Markley (T. P. & W.); Third Vice-President, R. H. Reid (L. S. & M. S.); Fourth Vice-President, R. C. Sattley (C. & N. W.); Secretary, S. F. Patterson (B. & M.), re-elected; Treasurer, C. P. Austin (B. & M.), re-elected; Executive Committee, W. O. Eggleston, A. E. Killam, H. Rettinghouse, J. S. Lemond, W. H. Finley, C. W. Richey.

Pittsburg was chosen as the next place of meeting.

Exhibits at the Convention of the Association of Railway Superintendents of Bridges and Buildings.

Following is a list of the exhibits at the convention:

American Track Barrow, Lowell, Mass.—Sample of the "Dandy" car and "Pony" car.

American Valve & Meter Co., Cincinnati, Ohio.—Catalogues and circulars of Poage water column.

Barrett Manufacturing Co., Chicago.—Samples of "Black Diamond" roofing and water proofing. Photograph of train shed of Dearborn Station, Chicago, covered with 1,600 squares of Barrett's three-ply prepared roofing; in service 12 years.

J. A. & W. Bird & Co., Boston and Chicago.—Samples of Rex "Flintkote" roofing and Magnite cold water paint.

F. W. Bird & Son, East Walpole, Mass.—Samples of Paroid roofing, Hydrex waterproofing felt and Neponset waterproof papers.

Boston & Lockport Block Co., Boston, Mass.—Samples of "Metaline" bushed tackle blocks.

Philip Carey Manufacturing Co., Cincinnati, Ohio.—Samples of Carey's magnesia flexible cement roofing, roofing paints and steam pipe covering. Catalogues and pamphlets.

H. Channon Co., Chicago.—Samples and photographs of steel and wood tackle blocks.

Cortright Metal Roofing Co., Philadelphia, Pa.—Samples of Cortright metal slates and Victoria shingles.

Paul Dickinson, Chicago.—Model of roundhouse equipped with movable telescoping smoke jacks, and cast-iron ventilators and chimneys.

Jos. Dixon Crucible Co., Jersey City, N. J.—Pamphlets describing Dixon's silica-graphite paint for the protection of steel.

Fairbanks, Morse & Co., Chicago.—Sample of Barrett No. 30 track jack. Small model of No. 8 direct-acting stand pipe. Catalogues, pamphlets and drawings.

Gifford Bros., Hudson, N. Y.—Working models of ice-handling machinery.

Heath & Milligan Manufacturing Co., Chicago.—Piece of steel plate painted with the company's protective paint, taken from North Western elevated structure, Chicago, after 8 years' service.

Illinois Malleable Iron Co., Chicago.—Small model and blueprints of the Bruyn automatic swinging smoke-jack.

Industrial Works, Bay City, Mich.—Blueprints and photographs of pile drivers and wrecking cranes.

Link-Belt Machinery Co., Chicago.—Photograph of 500-ton coaling station for B. & O. S. W. Ry.

Mann-McCann Co., Chicago.—Sectional model showing the Ravelin system for electric wiring roundhouses, blacksmith shops, foundries, etc.

The Miller Anchor Co., Norwalk, Ohio.—Model of the Miller anchor for derricks and wrecking purposes, and auger for setting same.

Geo. P. Nichols & Bro., Chicago.—Photographs and drawings of transfer tables, turntables and drawbridge machinery.

Otto Gas Engine Works, Chicago.—Blueprints and photographs of Otto standpipes, Otto tank valves and fixtures, gasoline coaling stations, and sand blast car. Samples of tank valve and Otto track jack.

St. Louis Expanded Metal Fireproofing Co., St. Louis, Mo.—Copies of book entitled "Corrugated Steel Bars as Applied to Steel-Concrete Construction."

Standard Paint Co., New York and Chicago.—Samples of "Ruberoid" roofing, P. & B. and "Giant" insulating and building papers and P. & B. paint.

Stowell Manufacturing & Foundry Co., South Milwaukee, Wis.—Samples of Wilbern door hangers, "Matchless" and "Climax" hangers and "315" baggage car door hanger; warehouse door latch.

Trussed Concrete Steel Co., Detroit, Mich.—

Samples of "Trus-Con" bars and Kahn trussed bars.

Variety Manufacturing Co., Chicago.—Working model of Cross horizontal folding door and Cross freight elevator door.

The Haberkorn Valve Mechanism for Locomotives.

The Haberkorn Engine Company, Fort Wayne, Ind., maker of stationary engines with a steam distribution for which Corliss economy is claimed at high speeds, has adapted its valve mechanism to locomotive use also. In the accompanying illustrations Fig. 1 shows a sectional plan of valves and cylinder and Fig. 2 the operating and controlling gear. Two piston valves are used, one of which (the upper in the view) is the cut-off valve and the other the main or distribution valve. They are driven from the usual arrangement of eccentrics through a stationary double link and radius rods. The reverse lever is connected to the radius rod of the main valve through the usual reach rod, tumbling shaft and hanger. The radius rod of the cut-off valve is attached to a second tumbling shaft which is bored to receive the main tumbling shaft and is supported by the latter. The second tumbling shaft is connected by a reach rod to a crank shaft to which is keyed a worm segment enclosed in a casing. This is in the cab convenient to the engineman and has a dial and pointer for indicating the cut-off. The center is the "full-stroke" position, the cut-offs decreasing as the pointer is moved forward or back of this point. The cut-off valve is given $^{1}/_{16}$ in. negative lap. The indicator should therefore be in the central position for starting trains and for switching, as by reason of the negative lap and minimum travel of the valve it performs no function at all in this position, its cut-off being delayed until after the main valve has cut off.

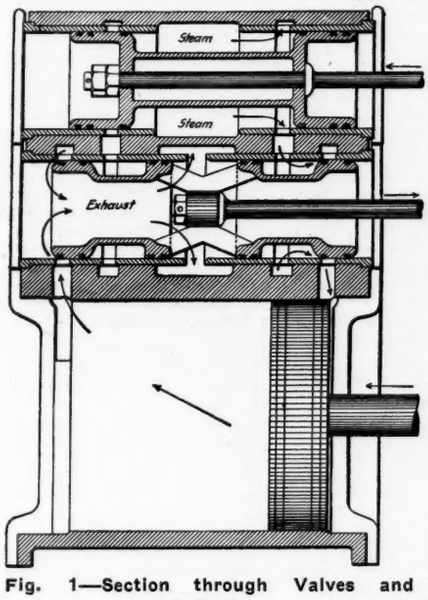


Fig. 1—Section through Valves and Cylinder.

The reverse-lever quadrant has but four notches—a full stroke, a running, a central and a back-up notch. The first gives a 90 per cent. cut-off, the second 75 per cent., and the back-up 80 per cent. In the running position, release occurs at about 90 per cent. of the stroke and exhaust closure, or compression, at about 80 per cent. This, of course, applies to the main valve only, without regard to the cut-off valve. It will be observed that the two valves receive their motion from opposite eccentrics. Should the gear be in forward motion with a short cut-off for instance, and it is desired to reverse the engine quickly, it would only be necessary to throw the reverse lever; for though the valves would then be moving in the same direction the travel of the cut-off valve and the influence of its negative lap are such that the main valve would control. A result obtained with the cut-off valve which is directly opposite to that given by the usual valve is that minimum slow travel produces a long cut-off and maximum fast travel a short cut-off.

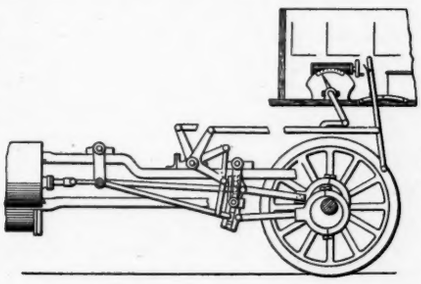
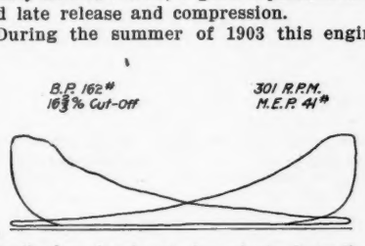


Fig. 2—Haberkorn Locomotive Valve Gear.

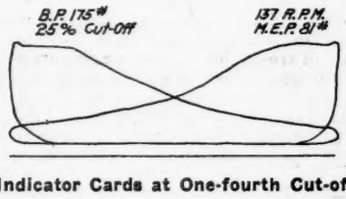
A Wabash locomotive with 18-in. x 24-in. cylinders and carrying 175 lbs. boiler pressure was equipped with this mechanism something over a year ago. It has 3½ per cent. clearance, and a 5-in. valve travel in full gear, which at 25 per cent. cut-off produces $^{5}/_{32}$ in. lead and $^{13}/_{16}$ in. port opening. The clearance given includes only that of the cylinder and the ports under the main valve. The steam space around the latter increases this clearance to 9 per cent., but this additional 5½ per cent. is in communication with the cylinder only during admission and expansion, affecting the curve of the latter favorably, and is cut off during release and compression. The volume to be filled during the latter event is therefore only 3½ per cent.

This locomotive has been tried in different kinds of service, and has been continuously in passenger service for 14 months. Two sets of indicator cards taken from this engine are shown, one of which was taken at 16⅔ per cent. cut-off, 301 r.p.m., position of reverse lever and worm gear being as shown in Fig. 2. The other was taken at 25 per cent. cut-off, 137 r.p.m., with ⅛ in. smaller nozzle than the first, which explains the higher back pressure. The load of the engine in both cases was five cars weighing 300 tons. Both cards show an excellent steam distribution with free admission, clearly-defined cut-off, a good expansion line, and late release and compression.

During the summer of 1903 this engine pulled daily, for three months, a train of six Pullman cars weighing 360 tons over a 105-mile division in 2 hrs. 13 mins., making five stops, on a consumption of 4,400 gals. of water and 4 tons of coal. Locomotives of the same type with ordinary valves used on the same run 6,600 gals. of water and 6 tons of coal. The Haberkorn locomotive, except at starting, was at no time run at greater than 25 per cent. cut-off, and often when running at speed this was reduced to 18 per cent., where road conditions permitted.



Indicator Cards at One-sixth Cut-off.



Indicator Cards at One-fourth Cut-off.

The directions to enginemen are to run with a full throttle and the shortest possible cut-off, which is easily and quickly regulated by the worm gear, even at high speeds. In view of the difficulty of shifting the reverse lever of ordinary gears at speeds above 30 m.p.h., especially on the large locomotives, this is a feature that is not only appreciated by the engineman, but is productive of the most economical operation of the engine by enabling the runner to readily and quickly change the cut-offs to meet the constantly varying conditions of the line. He does not have to touch his lever except to change to running position. The lever, however, may be shifted at any time with one hand.

The locomotive was equipped under the supervision of Mr. E. F. Needham, Master Mechanic at Fort Wayne. It has been in the shop for flue work and tire turning, but no repairs to the valve gear have been necessary. The valves for this 18-in. cylinder are each 8 in. in diameter and the parts of the gear are much lighter than those ordinarily used. Lost motion, which may be a seriously disturbing factor in the ordinary gear at short cut-offs, has no appreciable effect with this gear because of the large port openings.

Train Accidents in the United States in September.[1]

unf, 2d, 1 a.m., Louisville & Nashville, Hubbard Springs, Va., a freight train was derailed by a landslide and the engine and nine cars were wrecked. The fireman was killed and two other trainmen were injured, one of them fatally.

rc, 3d, St. Louis & San Francisco, Rolla, Mo., freight train No. 37 ran into the rear of a preceding freight (No. 35), wrecking the engine and seven cars, most of which fell down a bank.

After the accident two passenger trains following these freights arrived and were set on a side track a short distance in the rear. The engine of the leading passenger train was run forward to pull back a part of freight train No. 37, and, on returning, backed violently into the baggage car of its own train, crushing one end of it; at the same time, the passenger train was pushed back into the engine of the second passenger train, doing considerable damage. This collision was due, it is said, to the misplacement of a switch. Fifteen passengers were injured.

bc, 6th, 4 a.m., Buffalo, Rochester & Pitts-

[1]Accidents in which injuries are few or slight and the money loss is apparently small, will as a rule be omitted from this list. The official accident record published by the Interstate Commerce Commission quarterly is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defects of roadway.
eq	Derailments; defect of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

burg, Carman, Pa., butting collision of freight trains, making a bad wreck. One brakeman and one fireman were killed and three trainmen were injured. The conductor and engineman of the northbound train misread an order, calling "Carrier" "Carman."

†unx, 6th, Wabash road, Pendleton, Mo., a passenger train running at high speed was derailed and one passenger car and one dining car fell down a bank. Eight passengers were killed and 35 passengers and four trainmen were injured. The derailment occurred on a tangent, and careful investigation was made to discover its cause, but no evidence of defect was found, either in track or cars.

dn, 7th, 11 p.m., Pennsylvania road, Gallitzin, Pa., a freight train which became uncontrollable on the steep descending grade at that point was derailed and 20 cars fell down a bank. Two trainmen were killed and six injured.

†unf, 7th, Wheeling & Lake Erie, Chagrin Falls, Ohio, a mixed train consisting of an engine and nine cars, four of which were ahead of the engine, with a caboose in front, carrying one passenger, was derailed by running over a farmer's wagon at a crossing. The passenger and the conductor, who also was in the caboose, were killed, and two brakemen were injured. The man on the wagon was injured.

eq, 7th, 9 p.m., Chicago, Rock Island & Pacific, Tiskilwa, Ill., several cars in an eastbound freight train were derailed by the sudden stoppage of the train in consequence of the bursting of an air-brake hose, and a part of the wreck fell upon the westbound track.

†Westbound passenger train No. 11 came on immediately after and ran into the wreck, and the engine and several cars of the passenger train were badly damaged, the engineman not having time even to close the throttle. Two passengers and two employees were killed and 27 passengers and three employees were injured. None of the injuries were very serious.

bc, 8th, Norfolk & Western, Ardell, W. Va., butting collision of freight trains, wrecking both engines and 30 cars. A tramp was killed and one fireman was fatally injured. It is said that the collision was due to the mistake of an operator in delivering orders.

rc, 9th, Northern Pacific, Sand Point, Idaho, a freight train drawn by two engines ran into the rear of a preceding freight in the yard, wrecking both engines and several cars. A telegraph operator in the caboose of the leading train was fatally injured.

†unf, 9th, 1 a.m., Seaboard Air Line, Monroe, N. C., passenger train No. 41 was derailed just as it entered upon a trestle bridge 262 ft. long, and the whole train, except the engine and first two cars, fell into Catawba river or into the meadow adjoining the river. The engine crossed the bridge on the sleepers. The engineman, fireman and two passengers were killed and nine passengers and three trainmen were injured.

Every trainman being injured, no danger signal was sent back and in a few minutes an empty engine following ran into the chasm created by the wreck and fell on the passenger cars. The engineman of the empty engine was killed. The derailment of the passenger train was caused by malicious loosening of a rail.

bc, 10th, Buffalo, Rochester & Pittsburg, Mumford, N. Y., butting collision between northbound freight train No. 24 and a southbound train consisting of an engine and caboose. Three trainmen were killed and several others injured. It is said that the northbound train had disregarded a meeting order.

unf, 11th, 1 a.m., Central of Georgia, Ogeechee, Ga., a passenger train was derailed at a switch which had been maliciously misplaced and the engine was overturned. The fireman was killed and the engineman and two other trainmen were injured.

unx, 11th, 8 p.m., St. Louis, Iron Mountain & Southern, Arkadelphia, Ark., a dead engine in a freight train was derailed on a bridge and, knocking down the trusses, fell, with one span of the bridge and eight loaded cars, into Ouachita river.

unx, 11th, Vandalia Line, Collin, Ind., a work train broke through a trestle bridge, and four cars fell to the ravine below. The conductor and two brakemen were injured.

*rc, 12th, Atchison, Topeka & Santa Fe, St. John, Kan., rear collision of freight trains, wrecking engine and four cars. The wreck took fire and was mostly burnt up. One fireman and two brakemen were killed and the engineman was injured.

*rc, 12th, Wabash road, Paris, Mo., a freight train standing at a water tank was run into at the rear by a following freight, badly damaging engine and several cars. The wreck took fire and, with two spans of a bridge, was burnt up.

bc, 12th, Southern Pacific, Reno, Nev., butting collision of passenger trains, each drawn by two engines, wrecking all four engines and several baggage cars and passenger cars. A fireman and a coal passer were killed and 12 passengers were injured.

xc, 13th, Cincinnati, Hamilton & Dayton, Glendale, Ohio, a passenger train ran over a misplaced switch and into the head of a freight train standing on the side track, wrecking both engines and several cars. The passenger engineman was killed and the fireman fatally injured.

dn, 17th, Lake Shore & Michigan Southern, Chicago, Ill., a passenger train was derailed at a misplaced switch and the engine was overturned. The engineman and six passengers were injured.

xc, 18th, Long Island road, Long Island City, N. Y., collision of passenger trains, near the terminus, badly damaging one engine and several cars. Both firemen were killed. The collision is said to have been due to a misplaced switch.

bc, 19th, Baltimore & Ohio, Flushing, Ohio, butting collision of freight trains in a tunnel, wrecking both engines and several cars. Four trainmen were injured.

bc, 19th, Cincinnati, Hamilton & Dayton, Toledo, Ohio, butting collision of passenger trains; 30 persons injured.

dr, 19th, Union Pacific, Kansas Falls, Kan., passenger train No. 4 was derailed and all of the cars were ditched, one sleeping car being overturned; 11 passengers were injured. It is said that the track was undergoing repairs at the time and had been left insecure.

unf, 19th, Yazoo & Mississippi Valley, Mileston, Miss., a passenger train was derailed by running over a cow, and the engine was wrecked. The engineman was fatally injured.

unx, 21st, St. Louis, Iron Mountain & Southern, Sageeyah, Ind. T., a freight train was derailed and the engine was wrecked. The engineman was killed and the fireman injured.

unx, 21st. Norfolk & Western, Lockburn, Ohio, a passenger train was derailed and the engine was overturned. The engineman was killed and the fireman fatally scalded.

unf, 21st, Illinois Central, Barclay, Ill., a passenger train was derailed at a switch which had been tampered with, and several cars were ditched. The fireman was killed and the engineman and several passengers were injured.

bc, 21st, Buffalo & Susquehanna, East Nichols, N. Y., butting collision between a passenger train and a freight, overturning the passenger engine; engineman killed and two other trainmen injured.

xc, 23rd, 1 a.m., Missouri, Kansas & Texas, Lewis, Mo., a passenger train, running at high speed, ran over a misplaced switch and collided with a freight train standing on the side track, wrecking the engine and five freight cars. The engineman was killed and two passengers were injured. It is said that the switch was unlighted because the supply of oil had run out. The agent at the station had suddenly left and the duty of attending to the lights had devolved on the section boss.

o, 23rd, Baltimore & Ohio, North Branch, Md., a freight train was wrecked by the explosion of 850 lbs. of dynamite in a wagon which was being moved across the track in the face of the freight. In the explosion one trainman was killed.

†bc, 24th, Southern Railway, Hodges, Tenn., butting collision of passenger trains, resulting in the death of 59 passengers and trainmen and the injury of over 100 others, some of them fatally. The trains in collision were passenger train No. 15 westbound, from Bristol to Knoxville, and passenger train No. 12 eastbound from Chattanooga to Salisbury. The westbound train disregarded an order to wait at Newmarket for the eastbound. The engineman of the westbound is among the killed. A large majority of the persons killed were in the forward passenger cars of the eastbound train; these cars, being of lighter construction than the sleeping cars in the rear of the same train, were crushed by the latter.

†dr, 25th, 4 a.m., New York Central & Hudson River, Lock Berlin, N. Y., a westbound passenger train was derailed by a broken rail and three sleeping cars fell across the eastbound freight track. A freight train came along a moment afterward and ran into the wreck, demolishing the cars and injuring 25 passengers, one of them fatally.

†unf, 26th, Chicago, Burlington & Quincy, Elmwood, Ill., a passenger train was derailed by a washout and the baggage car and smoking car were wrecked. One passenger was killed and 15 were injured, three of them fatally.

*xc, 26th, Maine Central, Lewiston, Me., a passenger train ran over a misplaced switch and collided with a freight train standing on a side track, making a bad wreck, which took fire and was mostly burnt up. The parlor car was overturned. The engineman, fireman and mail agent were killed and two passengers and seven trainmen were injured, one of the latter fatally.

unf, 26th, Michigan Central, Linwood, Mich., a passenger train was derailed by running over a cow; engineman killed, two other trainmen injured.

dn, 27th, 2 a.m., St. Louis, Iron Mountain & Southern, Vulcan, Mo., passenger train No. 17 was derailed by running at high speed when entering a curve and several passenger cars were badly damaged; two of them fell down a bank into a stream of water; 34 passengers were injured.

unf, 27th, Chicago, Burlington & Quincy, Wheeler, Kan., a mixed train was struck by a tornado and both of the two passenger cars were thrown into the ditch; but they were not overturned and the passengers were not seriously injured. Several freight cars were wrecked.

bc, 28th, Western New York & Pennsylvania, Franklinville, N. Y., butting collision of freight trains, wrecking the engines and eight cars. One brakeman was killed. There was a dense fog at the time.

rc, 29th, Atlantic Coast Line, Charleston, S. C., an express train which was unexpectedly stopped was run into at the rear by a following local passenger train, damaging the rear car. It is said that the stoppage of the leading train was due to the accidental pulling of the bell cord by the porter of a sleeping car while making up a berth.

bc, 29th, New York, Ontario & Western, Preston Park, Pa., butting collision of freight trains due, it is said, to a misunderstanding of orders. The fireman was killed and three other trainmen were injured.

unx, 29th, New York, New Haven & Hartford, South Weymouth, Mass., a passenger train was derailed and the engine fell down a bank. The fireman was killed and the engineman and two other trainmen were injured, the engineman fatally.

dn, 29th, Norfolk & Southern, Elizabeth City, N. C., freight train No. 10 ran into an open draw, and the engine and one car fell to the bottom of the stream. It is said that the engineman was unable to stop the train because of a defect in the brakes.

Locomotive Tests at St. Louis.

The locomotive testing plant of the Pennsylvania Railroad Company has been in operation since May 4 last, and the first official test was run on May 25. The accompanying table gives the general dimensions of the engines which have been subjected to tests up to date. The first engine tested was the Pennsylvania simple H6a standard consolidation freight locomotive. The second was the Lake Shore simple consolidation. The third was the Michigan Central two-cylinder cross compound consolidation, and the fourth was the four-cylinder tandem compound (2-10-2) freight locomotive of the Santa Fe. These first four engines are all used in freight service and the results of the tests should show the relative advantages of simple and compound cylinders for this class of service. The fifth engine tested was the de Glehn four-cylinder balanced compound owned by the Pennsylvania, and the sixth engine, the tests on which have just been completed, is the Santa Fe four-cylinder balanced compound built by the Baldwin Locomotive Works.

It is the intention, if time permits, to test several other engines before the close of the Fair, among which are the Cole four-cylinder balanced compound owned by the New York Central, the four-cylinder balanced compound built by the Hannover Machine Works of Germany, the Pennsylvania E2a standard high speed Atlantic type locomotive, the Michigan Central 4-6-2 simple passenger locomotive, and the New York Central simple Atlantic type locomotive.

LOCOMOTIVES TESTED AT ST. LOUIS.

	Name of road.	Type of engine.	Cylinders.	Diam. of drivers, ins.	Total weight of engine, lbs.	Cylinder dimensions, ins.	Tubes. No.	Tubes. Diam., in.	Tubes. Length, Ft. & in.	Grate area, sq.ft.	Heating surface, sq. ft. (outside).	Ratio heating surface to grate area.
No. 1.	Penn. R. R.	2-8-0 (H6a)	Simple	56	194,200	22 x 28	373	2	13 8½	49.1	2,843.6	57.9
No. 2.	L. S. & M. S.	2-8-0	Simple	63	181,300	21 x 30	338	2	15 0	33.5	2,857.0	85.8
No. 3.	Mich. Central	2-8-0	Two cyl. comp.	63	189,000	23 & 35 x 32	363	2	15 7	49.4	3,181.0	64.4
No. 4.	A., T. & S. F.	2-10-2	Tandem comp.	57	285,740	19 & 32 x 32	393	2¼	20 0	58.5	4,817.3	82.4
No. 5.	Penn. R. R.	4-4-2 (de Glehn.)	Balanced comp.	80 9/16	162,000	14.1 & 23.7 x 25.2	139*	2¾	14 5¼	33.4	2,656.0 (inside)	79.5
No. 6.	A., T. & S. F.	4-4-2	Balanced comp.	73	187,000	15 & 25 x 26	273	2¼	18 1	49.4	3,029.0	61.3

*Serve tubes.

Protecting Low Structures Over Tracks From Locomotive Gases and Blasts.

The report on this subject submitted to the meeting of the Superintendents of Bridges and Buildings at Chicago, October 19th, is made up of several letters, of which the following are extracts:

New York, New Haven & Hartford.—"We have a tunnel under a hotel where the hotel is supported by box girders, and the under sides of these girders were covered with expanded metal and two coats of cement plaster put on to this metal. We have had no trouble with the cement, but we have had trouble with the expanded metal rusting off and the whole thing falling down. When this was originally built this was put on with plenty of time for it to set up and get in good shape before any engine passed under it. The original coating has all fallen off, as I have said, on account of the expanded metal rusting off, and we had it put on again one year ago, and it has nearly all come off the second time. We have something like 70 regular trains which pass under this structure working steam. This structure is only about 250 ft. from where the trains stop at the station. They are long, heavy trains, and are working pretty hard. At the point where our cement plaster is located there is more or less moisture that gets into this from somewhere that seems to affect this expanded metal. I have about made up my mind that the best thing in a new structure is to provide metal enough to stand the wear of the blast, and put on paint that will take care of the gases by applying often enough so that the gases won't get at the iron. I have had better success with graphite paint for this kind of work than any other. There is no danger of the iron rusting out where you sand blast it off 70 times a day, as we do this. This structure is about 15 ft. above the top of the rails."—Grosvenor Aldrich.

Boston & Maine.—"I have no hesitation in saying concrete, in answer to the question as to the best material to be used for protection of any style of metal overhead bridge. The concrete to be made of Portland cement, and an aggregate not exceeding pea size. As to the best method of application: The concrete must be applied in some way so that it will be homogeneous and continuous throughout. Expanded metal under lower flanges is excellent to reinforce the concrete, but it must be embedded in the concrete at least one inch clear of the flange.

"Great care and very wet concrete must be used in conjunction in order to get a proper bond with the work above. If the under side of the flanges are packed first, and the edges of the expanded metal, or other bonding material, left exposed with the idea of being later packed in concrete arches or other filling, there will result a joint between the hardened concrete under the flange and the filling work that will admit engine gases which will rust off the reinforcing metal, and sooner or later the concrete below the flanges will drop off. This result has happened, and it gives a bad name to concrete protection, while the fault lies with the method of doing of the work rather than with the material or general method.

"Without doubt the best results would be obtained from a design of iron work that would admit a form of matched boards suspended by wires about two inches below the iron, and then to fill the whole with very soft, fairly rich, concrete. The outsides of girders or trusses should be covered as well as the inside.

"A great help to ordinary paint is a close sheathing of matched boards under the iron work, which presents a plane surface underneath. In this case the rush of air from the passage of the cars following an engine cleanly sweeps the gases from under the bridge so there is very little opportunity for the acids to get in their work. Where the floor is framed in the ordinary way, the smoke lingers a long time under the bridge until it cools enough to drop out of the pockets of the framework by gravity.

"The ordinary method of protection is by paint. This, for structures subject to engine gases, should not be made of metallic pigment of any kind. These gases where severe will cut the best lead paints as quickly as naked iron. Only inert pigments should be used. Carbon, graphite, or gums are not so affected."—J. P. Snow.

Lake Shore & Michigan Southern.—"I do not know of a thoroughly good protection against smoke, gases, and cinders which is practicable of application on overhead bridges. We are 'up against' that proposition hard on the Lake Shore, and have used paint in liberal quantities and at frequent intervals to endeavor to preserve our structures, but not with entire satisfaction up to the present, though we hope by more liberal and frequent use of first class paint to improve the conditions."—R. H. Reid.

St. Louis Southwestern.—"I consider the best method of protecting low overhead structures from smoke and gases and from blasts from locomotives is to keep the structures well protected with a good quality of paint. There are quite a number of paints specially made for protecting against locomotive smoke and gases that I believe would stand the test. I do not think it is practicable to cover them on the under side, as I would consider it a dangerous practice. The covering might become loose, and, by sagging, cause an accident to men on top of freight cars while trains are passing under, or it might fall on the train and do damage."—J. S. Berry.

South Terminal, Boston.—"In the train shed at the Boston Terminal, it is found that the cold condensed gases from locomotives do most damage, in some cases completely destroying 14-ounce copper in less than two years. Hot locomotive gases seem to have very little effect on the metal work where the latter is not exposed directly to the blast."—E. J. Beugler.

Mr. H. K. Higgins, Principal Assistant Engineer of the New York, New Haven & Hartford, writes as follows: "Only a small proportion of such surfaces will be subjected to blast action, usually not to exceed about 30 in. in width directly over the centers of tracks. The subject should therefore be considered under two heads: *A*, metal exposed to gas only; *B*, metal exposed to gas and blast action.

"*A*. Metal exposed to gas only, hot or cold, wet or dry, can be positively protected by coating it with any inert, incorrodible substance. Ordinary paint does not fill the bill. A coating of hot asphalt applied to heated iron has in some cases proved entirely effective. Care must be taken that the asphalt is so manufactured, or rather refined, that it will contain little volatile matter, and of such origin and quality that it will not grow brittle and crack. It is easy to fail in either direction. Asphalt cut or dissolved in fluids, such, for example, as carbon disulphide, and applied cold, drying by evaporation, leaves a porous coating, and is consequently of little value unless burned or baked on. Possibly some other substance could be found which would improve the mixture.

"Linseed oil, which forms the base of all ordinary paints, even when pure, is destructively affected by sulphurous acid. So, also, are most, if not all, varnishes. In many cases, however, especially of old structures, nothing but paint can be used, and it becomes necessary to make the best of a bad matter and use the best paint possible. Some experiments made eight years ago indicate the value of a paint made by adding powdered graphite to an ordinary red lead paint mixed as thick as brushes will work. The eight years' test shows that with not too

severe conditions such paint, two coats, will last eight, and possibly ten, or more years. The philosophy of it is that the red lead and oil form a cement which holds the graphite in place. The surface consists of graphite, which resists the action of acid and water as well as gas direct.

"Of course any paint must be applied to a clean surface. This is difficult to obtain, but a *sine qua non* for success. The deservedly much-lauded sand blast will do the trick, but it must be used with discretion. The sand will cut iron or steel surprisingly fast. Iron, when kept properly painted, should have little need of sand blast cleaning.

"*B.* The sand blast action of a locomotive exhaust adds a very serious complication. On lines of heavy traffic it will cut through a 1-in. pine board in three months. About 30 trains a day starting from a station stop will cut through 1½ in. of Portland concrete in about four years. Concrete reapplied will not last nearly so long.

"In a comparatively recent bridge near Boston the bottom flanges of I-beams were covered with a $^1/_{16}$ in. sheet of lead. This lasted some six months under very unfavorable conditions. Possibly a plate of say ¼ in. would be better, as it would tend to cushion the blast action. The writer would like to see this tried.

"Another promising possibility is a cloth —not felt or paper but woven fabric—composed largely of asbestos or similar fibrous incombustible material soaked in raw asphalt; that is, asphalt of decidedly sticky, pitchy nature. This should cushion the blast, protect the iron, be easily applied, and not too expensive. Either lead or asphalted cloth could profitably be limited to a width of say 30 in. directly over track center, as only there is the sand blast effect seriously destructive."

Railroad Shop Tools.

(*Continued.*)

RADIAL DRILLS.

The universal radial drill shown in the accompanying illustration, Fig. 1, is made by the Niles-Bement-Pond Company, New York. It is made in several different sizes, the one shown being the 7-ft. size which will drill to the center of a 14-ft. circle. The maximum distance between the spindle and the face plate is 79½ in. and the traverse of the spindle is 22 in. A 5-h.p. motor running at a constant speed of 900 r.p.m. drives the spindle through a positive mechanical speed-changing controller. This controller consists of an oil-tight box containing an adjustable revolving cage in which are mounted five sets of gears. By moving the controller handle to any one of the five index points on the outside of the box, the adjustable cage is moved into a corresponding position and one pair of gears engage with the motor pinion and a central pinion mounted on the shaft leading to the machine, thus giving the desired speed. All of the gears in the cage which are not in actual use, remain idle because of the eccentric mounting of the cage inside the box. The device is arranged so that the working gears run in oil.

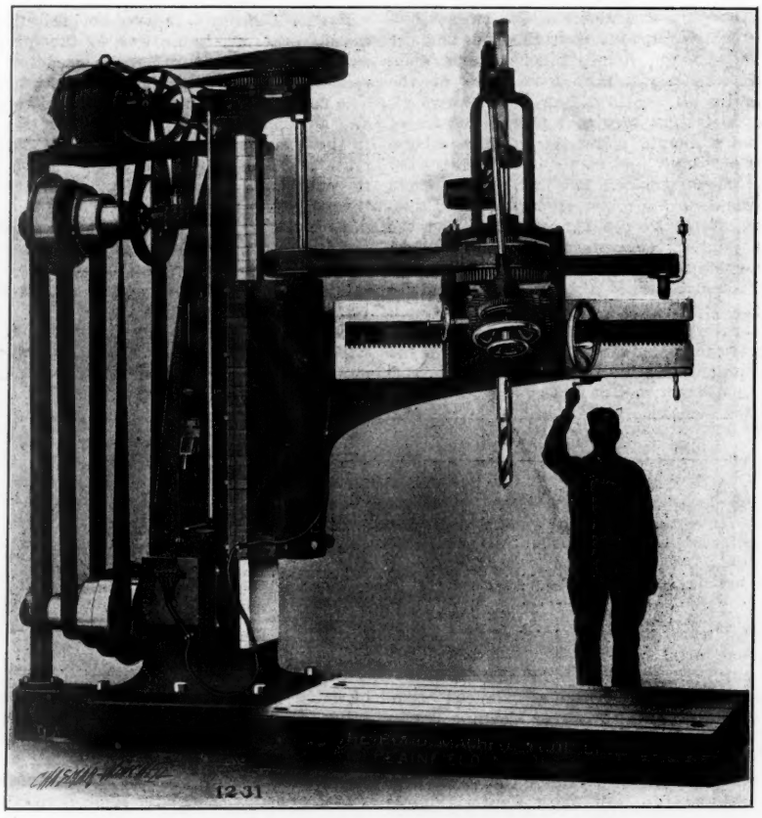


Fig. 2—Niles-Bement-Pond Plain Radial Drill.

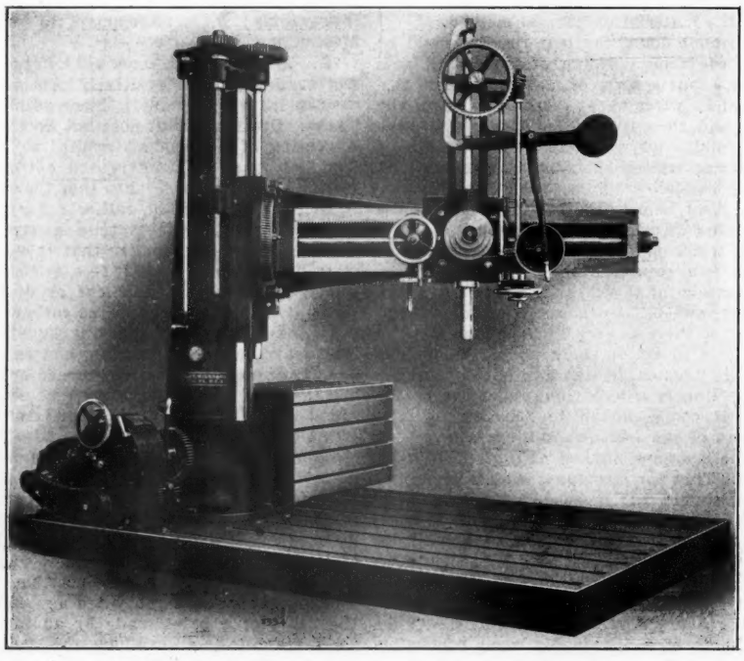


Fig. 1—Niles-Bement-Pond Universal Radial Drill.

Where a universal drill is not required, the 6-ft. plain radial drill, Fig. 2, made by the same company, is an efficient and useful tool. This machine has a wide floor plate, 9 in. deep, to which the upright column is bolted. The column has a broad flat wearing surface for the saddle which can be raised or lowered by power. The swinging arm is mounted on the saddle and has a vertical adjustment of 48 in. It is not necessary to clamp the saddle to the upright when drilling and for this reason the time lost by loosening and tightening the binder bolts is saved. The spindle, which is counterbalanced, has an adjustment of 18 in., and the maximum distance between its lower end and the floor plate is 89 in. The smallest radius of the spindle is 16 in. and the greatest radius is 72 in. From the face of the upright to the center of the drill, the minimum distance is 25 in. A rack and pinion movement is provided for raising and lowering the spindle and for the traverse of the saddle on the swinging arm. These are so arranged that the operator can control both movements and swing the arm at the same time. Six changes of spindle feed are obtained by means of an automatic friction feed device. The belt for driving the spindle runs over a pulley keyed to the upper end of the spindle and the back gears are arranged the same as on a lathe. When required for heavy drilling they can be thrown

in and out readily. A compact arrangement of motor drive is shown in the illustration of this machine.

The 5-ft. radial drill made by the Hamilton Machine Tool Company, Hamilton, Ohio, and shown in Fig. 3, has a base 60 in. x 115 in. in which T-slots for clamping are formed as shown. The column is of box section and is mounted on a heavy stump which extends up inside to the full height of the column. At the bottom of the stump is a circular anti-friction bearing so that the column can be easily rotated through a complete circle. A sleeve clamp is provided for clamping it in any position. The arm is also made with a box section and slides on flat bearing surfaces formed on the column. It can be clamped at any desired height and is provided with gibs to take up wear. The arm is raised and lowered by power, the operating lever being located on the column and held in place by a locking pin so that it cannot be shifted by accident. A coarse-pitch screw is used for raising the arm and it turns in a bronze nut. Ball-bearings are provided at the top and bottom of this screw to save power. The drilling head can be moved along the arm either by a power screw or by a rack and pinion turned by a hand wheel. By means of a fixed lever it can be clamped to the arm at any point in its traverse. The spindle is made of crucible-steel and is counterbalanced; quick advance and return feeds are provided which can be operated by power or by hand. Threaded jam nuts are placed on the spindle above the sleeve to prevent it from being forced away from the work when heavy undercutting or facing is being done and ball-bearings are also provided for taking up the end thrust of the spindle.

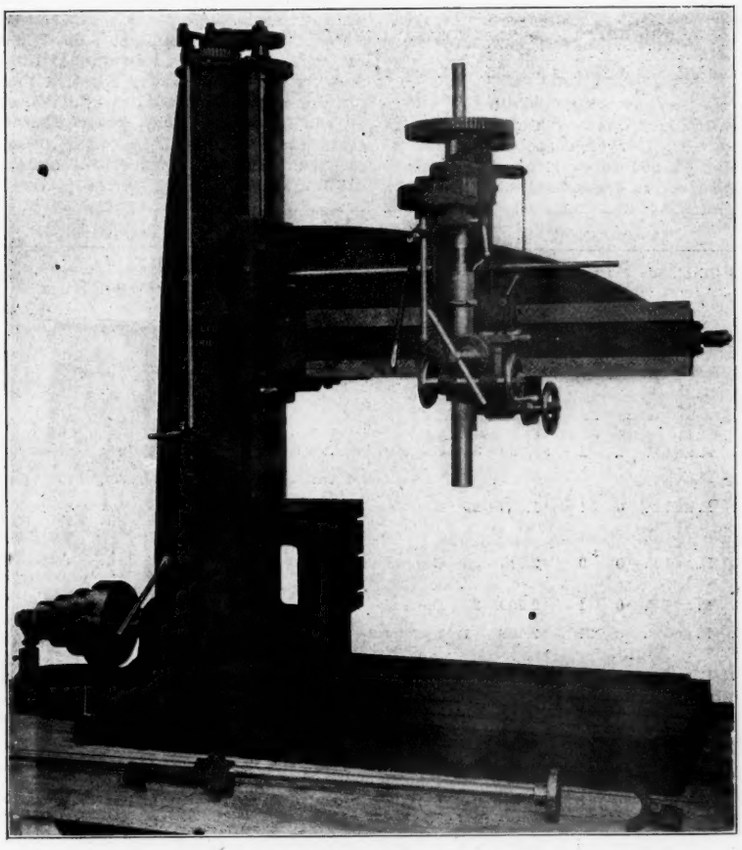


Fig. 3—The Hamilton Radial Drill.

The positive geared power feed used on this machine is shown in Fig. 4. It is enclosed in a cast-iron box and the changes of feed are produced by the two sets of gears driven directly from the spindle and operated by means of the two small levers shown underneath. The sliding shaft A, contains a movable key B, the corners of which are beveled so as to readily pass the adjacent gears when changing from one to another. By moving the shaft A, the key B can be engaged in any of the feed gears C, each of which is provided with four key-ways. The spring pin D is placed so as to constantly exert a pressure on the key sufficient to force it into the key-way whenever the two are opposite each other. The feed gears C are seperated by hardened steel collars so that the key must be entirely clear from one gear before it can engage another. Shaft A is hardened and ground and ample facilities are provided for oiling all of the working parts. The lower feed gears E, are friction driven, the object being to allow the gears to slip in case of a severe strain and thereby preventing damage to the gears to any other part of the machine. Six changes of feed ranging from .005 in. to .062 in. per revolution are provided by this mechanism for each of the spindle speeds. The feed worm is operated through a friction drive and can be quickly engaged or disengaged. The worm wheel is made of phosphor-bronze while the worm is of steel, and both are kept constantly immersed in oil.

An automatic stop is provided on the machine, which can be set for any desired depth by referring to the graduations marked on the spindle sleeve. The back gears are placed at the rear of the arm next to the column and are driven by a positive friction clutch

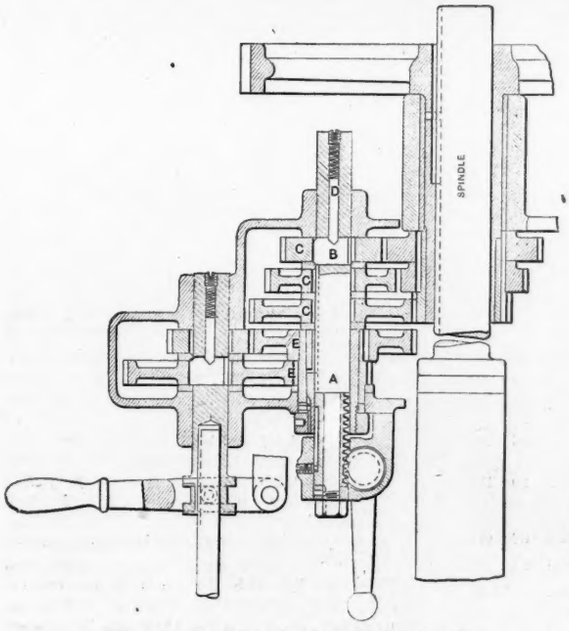


Fig. 4—Positive Geared Power Feed.

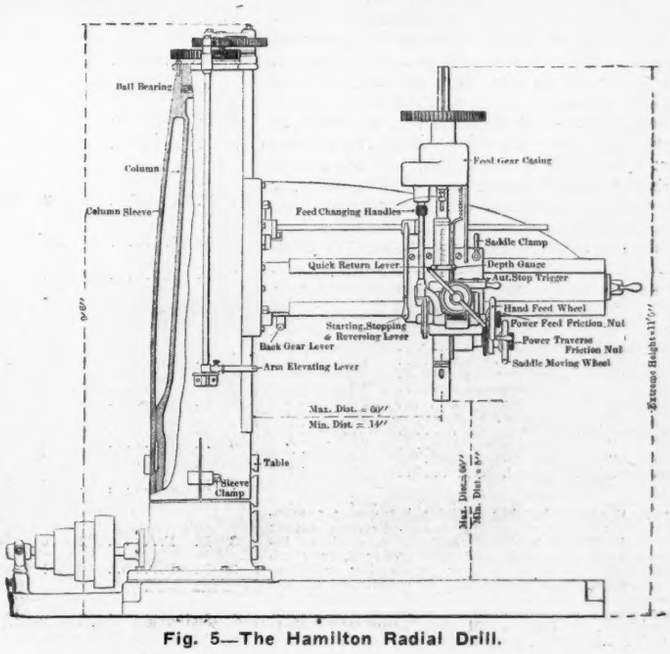


Fig. 5—The Hamilton Radial Drill.

which can be regulated to release at a given strain. The location of the operating levers is shown in the accompanying drawing, Fig. 5. The tapping device is arranged for both right and left-hand tapping. The upper lever is used for starting, stopping and reversing the spindle and the back-gear lever is used for producing slow back-gear speeds or fast belt speeds as desired. Thus, when tapping with back-gears engaged, after the tap has reached the required depth it is backed out at slow speed by shifting the upper or reversing lever, when, if desired, the back-gear lever may be thrown over, increasing the spindle speed and accelerating the return of the tap.

The machine is equipped with a plain box table, 22 in. x 22 in., which is provided with T-slots as shown. The principal dimensions of the machine are as follows:

Extreme height of drill	9 ft. 6 in.
Drills to center of a circle of	120 in.
Greatest distance from spindle to base	66 in.
Greatest distance from spindle to plain table	42 in.
Least distance from center of spindle to face of column	14 in.
Diameter of spindle, least section	2 1/16 in.
Spindle bored to fit Morse taper	No. 5
Traverse of spindle	18 in.
Vertical traverse of arm	40 in.
Horizontal traverse of head	46 in.

(To be continued.)

Accident Bulletin No. 12.*

The Interstate Commerce Commission has issued Accident Bulletin No. 12 for the three months ending June 30, 1904. The number of persons killed in train accidents was 167 and of injured 2,378. Accidents of other kinds bring the total casualties up to 12,095 (677 killed and 11,418 injured). These accidents are classified in the following table:

Table No. 1.—Casualties to Persons.

	Pass'rs Killed.	Pass'rs Inj'd.	Employees Killed.	Employees Inj'd.
Collisions	10	761	68	538
Derailments	12	343	55	385
Miscellaneous train accidents	1	30	21	321
Total train accidents	23	1,134	144	1,244
Coupling & uncoupling	...	...	60	746
While doing other work about trains or while attending switches	...	...	31	2,450
Coming in contact with over head bridges, structures at side of track, etc.	2	11	16	271
Falling from cars or engines or while getting on or off	29	331	133	2,019
Other causes	3	386	236	2,826
Total (other than train accidents)	34	728	476	8,312
Total, all classes	57	1,862	620	9,556

In train accidents, the total number of killed, both of passengers and of employees, is less than in the corresponding quarter of the preceding year; and the same is true of employees both in train accidents and in other classes. The reduction in the passenger death list is gratifying, but the yearly tables, given below, show, unfortunately, a large increase which completely neutralizes the decrease for the quarter.

Of the total in the table below 176 collisions and 144 derailments affected passenger trains.

Table No. 2.—Collisions and Derailments.

	No.	Damage.*	Persons Killed.	Persons Injured.
Collisions:				
Rear	235	$196,322	14	276
Butting	136	321,388	39	552
Train separating	212	97,815	9	102
Miscellaneous	597	256,712	16	369
Total	1,180	$872,437	78	1,299
Derailments:				
Defects of roadway	234	$161,114	5	208
Defects of equipm't	585	551,221	11	146
Negligence	58	47,249	7	42
Obstruction:				
Unforeseen	71	111,966	15	94
Malicious	62	13,613	12	67
Miscellaneous	228	257,652	17	171
Total	1,238	$1,142,815	67	728
Total, col. and d.	2,418	$2,015,252	145	2,027

*To road and equipment.

Following is the usual list of Class A train accidents—all in which the damage is reported at $10,000 or over, notable cases in which passengers are killed, and those doing damage less than $10,000 and down to $2,000, wherever the circumstances or the cause may be of particular interest.

The accident most fatal to passengers in this record was a derailment (No. 7 in the foregoing table). The cause, however, was one which constantly recurs in the collision record—forgetfulnes on the part of an engineman. In this case the man at fault was killed. The circumstances show the weakness and insufficiency of the requirement—ostensibly a safeguard—that the conductor of a train, equally with the engineman (so far as possible), shall guard against disaster. This requirement is found in all rule books. Theoretically, the conductor, in this case, having in his possession a copy of the slow-order, could have had his mind on the matter, approaching the sidetrack, and his hand on the emergency brake valve with which every car is equipped, and thus could have stopped the train in spite of the engineman's failure to act. But, practically, this safe-

*Following is a list of the accidents which occurred in the year covered by this bulletin, with the number of persons killed and injured in each:

			Killed.	Injured.
1.	July, '03.	Rockfish, Va.	22	25
2.	Aug., '03.	Durand, Mich.	22	15
3.	Oct., '03.	Lambertville, N. J.	17	35
4.	"	Indianapolis, Ind.	16	25
5.	Nov., '03.	Kentwood, La.	32	38
6.	"	Tremont, Ill.	16	20
7.	Dec., '03.	Godfrey, Kan.	7	21
8.	"	Laurel Run, Pa.	65	4
9.	"	East Paris, Mich.	18	57
10.	Jan., '04.	Willard, Kan.	18	37
			233	277

No. 1 was a butting collision between a passenger and a freight; 2, rear collision of circus trains; 3, rear collision of work trains; 4, collision between passenger train and yard train; 5, rear collision of passenger trains; 6, butting collision, freight train and work train; 7, derailment of passenger train due to failure to give stop signal; 8, derailment of passenger train by accidental obstruction; 9, butting collision, passenger trains; 10, butting collision, passenger and freight.

CAUSES OF TWENTY-SEVEN PROMINENT TRAIN ACCIDENTS (CLASS A).

[NOTE.—R. stands for rear collision; B., butting collision; M., miscellaneous collisions; D., derailment; P., passenger train; F., freight and miscellaneous trains.]

COLLISIONS.

No.	Class.	Kind of train.	Killed.	Injured.	Damage to engines, cars and roadway.	Reference to record.	Causes.
1	B.	F. and F.	1	2	$1,150	32	Collision between freight and work trains; work train pushing car ahead of engine; despatcher, 27 years' experience, overlooked eastbound extra when giving orders to westbound.
2	B.	P. and P.	0	51	1,750	25	Southbound train waiting on sidetrack as northbound train approached; a train porter, of three months' experience, became unaccountably confused and threw switch for sidetrack. Injuries slight.
3	B.	F. and F.	0	0	2,175	58	Conductor and engineman of extra train overlooked the fact that the time of regular train had been changed by new time-table issued that day.
4	R.	F. and F.	0	1	2,200	23	Block-signal operator (experienced) gave clear signal when block section was not clear.
5	R.	P. and P.	3	21	2,700	1	Engineman (experienced) ran past three automatic stop block signals; signals were 6,410 feet, 3,830 feet, and 1,330 feet back from point of collision; flagman also back 1,000 feet.
6	B.	P. and P.	0	10	2,754	48	Conductor of train No. 1 examined register and failed to note that train No. 2 had not arrived.
7	B.	F. and F.	3	3	3,025	57	Operator failed to deliver meeting order.
8	B.	P. and F.	2	24	4,100	4	Conductor and engineman, who had been on their trip only 15 minutes, overlooked meeting order.
9	B.	P. and F.	0	17	6,430	52	Engineman and fireman of empty engine overlooked meeting order.
10	B.	P. and P.	0	27	8,691	53	Conductor and engineman (experienced) forgot meeting order. Injuries of passengers slight.
11	M.	P. and F.	0	3	9,500	11	Cars of freight train left standing on main track while switching was being done on side tracks; engineman of freight in service only 2 weeks.
12	B.	F. and F.	0	3	13,000	29	Mistake of despatcher; sent conflicting orders when he could and should have used the "duplicate form," sending the orders to the two trains in the same words.
13	B.	F. and F.	1	3	13,400	9	Eastbound train had order to run 6 hours 20 minutes late; ran 6 hours 5 minutes late.
14	B.	F. and F.	1	5	15,000	8	Operator (experienced) reported that a train had not passed, when in fact it had, thereby leading to the delivery to another train of an order which caused collision.
15	B.	F. and F.	1	1	15,000	59	Engineman (who was killed) started from station, at beginning of trip, without order from conductor and without going to despatcher's office for orders as required by rule. Conductor, being in the office at the time, was left behind.
16	B.	F. and F.	0	2	20,000	49	Block signalman admitted westbound train to block section occupied by an eastbound train.
17	B.	P. and F.	2	25	20,000	6	Freight, waiting on a sidetrack, ordered to meet 3 trains, was started out after 2 trains had passed; conductor, engineman and flagman, while waiting, had slept, and on waking assumed that 3 trains had passed.
18	B.	P. and F.	1	8	21,575	28	Conductor and engineman of freight overlooked meeting point. (See further note in text below.)
		Total	15	206	$162,450	...	

DERAILMENTS.

1	D.	F.	0	2	$5,603	19	Brake-beam dropped and damaged air pipe; air-brakes became inoperative, and train ran away on steep grade. Men in charge had not complied with the rule requiring them to stop and inspect cars before descending grade, and also neglected to use hand brakes, in lieu of retaining valves, to partly control speed.
2	D.	F.	0	0	8,500	39	Air-brakes on one car, unknown to trainmen, remained applied, and heated a wheel, causing it to break.
3	D.	F.	0	0	10,000	18	Broken wheel flange.
4	D.	F.	0	2	10,165	14	Defective spindle in switch, allowing switch to become unfastened.
5	D.	F.	0	0	11,127	15	Broken wheel.
6	D.	F.	0	0	15,000	36	Thirty-four cars derailed, of which 23 were wrecked. Believed due to drawbar pulled out; speed of train, 45 miles an hour.
7	D.	P.	7	23	25,797	20	Engineman (who was killed) overlooked order to reduce speed on entering sidetrack at small station where main track was obstructed. Engineman, of 30 years' experience, on duty 4 hours.
8	D.	P.	1	6	30,000	67	Occurred 10 p. m.; washout at iron pipe culvert, caused by unusually severe local storm.
9	D.	F.	0	1	39,000	64	Derailment, caused by broken wheel flange: occurred an bridge; derailed cars knocked down 2 spans of bridge.
		Total	8	34	$155,192		
		Total col. and der.	23	240	$317,642		

guard fails in a large percentage of the emergencies which it is designed to provide for. The inadequacy of the requirement that the fireman shall be an assistant lookout man is also illustrated in this case. To be of sufficient value as a lookout to be relied upon firemen must not only be intelligent and experienced, but also must be trained in lookout duties.

In the collision record, the salient feature is the fact that three cases occurred on block-signaled lines. Two of these (Nos. 4 and 16) fortunately were unattended by fatalities; but the third, No. 5, killed three passengers. This case is somewhat similar to a notable one recorded in Bulletin No. 7 (January, 1903) where over 100 persons were killed or injured (23 deaths). In both cases the automatic block-signal equipment of the road was complete and in good order.

While, as in these cases, the block system, as used and administered on the best-managed railroads, does not provide against extreme recklessness or all kinds of gross negligence, and to that extent falls short of perfection, the roads not block signaled continue to fill the records with costly and fatal collisions, which the block system would undoubtedly have prevented. Nos. 1 and 12 in the present record were due to errors by despatchers—errors in work, the very essence of which is or should be constant watchfulness against errors. No. 8 records the forgetfulness of a conductor and an engineman whose minds had had only 15 minutes in which to lapse from their supposedly normal state of vigilance. No. 17 shows concurrent recklessness on the part of three men, or inexplicable dulness.

In No. 18 the engineman of the freight (who was killed) started out from a station on the time of a passenger train then due from the opposite direction. Either he forgot about the passenger train or assumed that a switching engine which had passed was the passenger train. The conductor of the freight, sitting in the caboose, heard the switching engine pass, but took no pains to identify it; the engineman having started the train immediately afterwards, the conductor then assumed that the switching engine was the passenger train.

The rest of the collisions in the table are no less worthy of attention, for they show costly blunders, which would be startling if they had not become so common.

YEARLY TABLES.

For the year ending June 30, 1904, the total number of casualties was 55,130 (3,787 killed and 51,343 injured). These totals are not comparable with those given in the Commission's Annual Statistical Reports, for the reason that the monthly reports deal only with accidents to passengers and employees while actually on duty. The monthly reports take no account of accidents to "other persons."

In Table B comparisons may be made of the totals of the principal classes of casualties. The large increase of 64½ per cent. in the number of fatal accidents to passengers (in train accidents) is but the record of a condition which has already been made familiar by the quarterly bulletins and by the daily newspapers month by month. This exhibit of the dangers of railroad travel is one which the most conservative must agree should be termed alarming, and each succeeding bulletin adds materially to the mass of evidence going to enforce the observations and recommendations which were made in the last annual report of the Commission.

TABLE A.—CASUALTIES TO PERSONS, YEAR ENDING JUNE 30, 1904.

	Passengers		Trainmen.		Trainmen in yards.		Yard trainmen.		Other employees.		Total employees.	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
Collisions	166	3,383	267	2,077	51	738	41	295	105	590	464	3,700
Derailments	103	1,422	229	1,078	20	196	20	201	16	264	285	1,739
Miscellaneous train accidents (excluding the above), including locomotive-boiler explosions	1	140	62	980	15	325	14	165	4	81	95	1,551
Total train accidents	270	4,945	558	4,135	86	1,259	75	661	125	935	844	6,990
Coupling and uncoupling	...	...	69	926	89	895	111	1,538	9	82	278	3,441
While doing other work about trains or while attending switches	...	...	51	4,788	48	2,279	40	1,815	69	1,779	208	10,661
Coming in contact with overhead bridges, structures at side of track, etc.	5	33	79	620	13	260	13	286	11	44	116	1,210
Falling from cars or engines, or while getting on or off	115	1,517	291	3,434	131	2,365	163	2,541	115	1,031	700	9,371
Other causes	30	1,582	133	559	120	412	86	398	882	10,224	1,221	11,993
Total (other than train accidents)	150	3,132	623	10,327	401	6,211	413	6,578	1,086	13,160	2,523	36,276
Total, all classes	420	8,077	1,181	14,462	487	7,470	488	7,239	1,211	14,095	3,367	43,266

TABLE B.—CASUALTIES FOR THREE YEARS.

	1904		1903		1902	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
Passengers: In train accidents	270	4,945	164	4,424	167	3,586
Other causes	150	3,132	157	2,549	136	2,503
Total	420	8,077	321	6,973	303	6,089
Employees: In train accidents	844	6,990	895	6,440	697	5,046
In coupling accidents	278	3,441	253	2,788	143	2,113
Overhead obstructions, etc.	116	1,210	93	992	104	1,070
Falling from cars, etc.	700	9,371	678	8,025	537	6,867
Other causes	1,429	22,254	1,314	20,759	1,035	18,615
Total	3,367	43,266	3,233	39,004	2,516	33,711
Total passengers and employees	3,787	51,343	3,554	45,977	2,819	39,800

TABLE C.—COLLISIONS AND DERAILMENTS.

	1904				1903		1902	
	No.	Loss.	Killed.	Injured.	No.	Loss.	No.	Loss.
Collisions	6,436	$5,190,918	630	7,083	6,167	$5,615,746	5,042	$4,285,683
Derailments:								
Due to defect of roadway, etc.	866	$612,538	33	716	821	$636,718	547	$443,706
Due to defect of equipment	2,297	1,953,392	60	630	1,841	1,502,325	1,609	1,295,299
Due to negligence of trainmen, signalmen, etc.	333	302,592	41	355	297	230,907	255	136,241
Due to unforeseen obstructions, etc.	336	402,417	132	416	277	317,456	239	546,478
Due to malicious obstruction of track, etc.	110	102,717	19	196	71	157,290	57	63,246
Due to miscellaneous causes	913	818,503	103	848	1,169	1,136,535	926	874,753
Total	4,855	$4,192,159	388	3,161	4,476	$3,981,231	3,633	$3,359,728
Total collisions and derailments	11,291	$9,383,077	1,018	10,244	10,643	$9,596,977	8,675	$7,645,406

Concrete and Concrete-Steel.*

It was about 1893 that the first important application of reinforced concrete, of which Monier appears to have had the first conception, was made in France. Since that time this new style of construction has been extensively used and its adoption seems destined to become still more general.

MATERIALS USED.

Cement.—Portland cement and other slow-setting cements are generally used in reinforced constructions. Lime is also used in the parts where the resistance or strength may be less, and quick-setting cements are used in the construction of pipes.

Proportions of Sand and Gravel.—Although silicious sands and gravels are preferable, those of calcareous nature may be used when the former are not available. The mixing is done in proportions varying as the sizes of the particles, and in order to reduce the voids to a minimum. In buildings, the usual practice is to add 300 kg. of cement to a total volume of 1.2 cu. m. of sand and gravel mixed, and it is assumed that, after losses at the mixing pans and after ramming, there is 1 cu. m. of concrete measured in place. In submarine works, the proportion of cement is increased to 500 or 550 kg. per cu. m., measured in place.

Water Used in Mixing Concrete.—Contractors, as a rule, use a concrete which is just moist enough to flow between the reinforcing members and coat them with cement, but, at the same time, is able to stand ramming. Some have advised the use of very wet concrete in moulds and forms perforated with holes through which the excess water can be drained; but several experiments have shown that the concrete thus made is greatly inferior as to its resistance and coefficient of elasticity.

Metal.—The cheapest quality of steel, having a strength of 40 to 45 kg. and an elongation of 20 to 26 per cent., is generally used.

ARRANGEMENT OF PRINCIPAL MEMBERS.

Members in Tension.—Until recently, the reinforced concrete was subject to tension in deflected members only. Lately, M. Vizentini used it in lattice girders, and the writer has used it in the construction of the chords and web members of the bow-string truss bridge tested to destruction at Ivry, Paris, in November, 1903. In both cases, the aim has been to give to the metal bars the same length as the members they reinforced, and in doing so, it was possible to obtain members which did not present sections of smaller resistance, such as are found in riveted members.

Members in Compression.—In France the practice is to reinforce compressed members with longitudinal bars or rods, connected at certain intervals by perforated diaphragms or by wires. In all calculations, the transverse ties are neglected, and the resistance of the metal is supposed to be added to the resistance of the concrete.

The upper chords of the Ivry bridge were designed differently. Helicoidal spiral rods were bedded in concrete near the surface, and against the inner face of these coils reinforcing longitudinal rods were placed. Several experiments and the Ivry test have proved that the spiral rods or hoops give to the core of concrete gripped within them a greater crushing strength—2.4 times greater—than the strength of longitudinal reinforcing members of the same weight.

Moreover, hooped concrete becomes about 20 times more ductile than concrete rein-

*Abstract of a paper by A. Considère, presented before the International Engineering Congress, St. Louis, October, 1904. Translated from the French by P. A. Seurot.

forced longitudinally, and, therefore, gives more surely and more completely the proper resistance of which it is capable, notwithstanding settlements of the abutments or the effects of expansion.

SLABS AND BEAMS SUBJECT TO FLEXURE.

Designers have endeavored to invent special arrangements, the description of which would be too long; only their essential differences will be mentioned herein.

Longitudinal Reinforcements. — Leaving out of consideration reinforcements latticed in some more or less rational way and skeletons built up of standard shapes and riveted members, the use of which has only a secondary importance in France, it may be said that, generally, the longitudinal reinforcements consist of round rods with smooth surfaces, and that the adhesion of the concrete is assumed to be sufficient to prevent slipping. Experiments have shown that such is generally the case under two conditions: good workmanship, and a relatively low ratio between the diameter of the rods and the span of the beams. It must not be concluded from this that bars with rough surfaces or with corrugations will not be useful, nor that the method of tying the longitudinal rods by transverse stirrups, as is done in foreign countries, could not be utilized.

Some designers have only reinforced along their whole length the lower fibers of members subjected to flexure, without trying to insure the resistance to tension of the upper fibers, above the supports, where bending moments of opposite direction to those existing at the middle of the span are developed. With this faulty disposition, serious breaks, not admissible in good construction, occur above the supports.

There are two rational types:

1.—In continuous beams the lower reinforcing members are generally carried throughout the entire length of the beams, and, in addition to these, upper reinforcing members are placed above the intermediate supports, the duty of which is to resist the negative bending moments.

The upper reinforcing members are extended throughout the entire length of the beams when the concrete has not strength enough to resist all the strains, or simply when it is found convenient to do so in order to fix the transverse ties.

2.—In the second type, recommended and used by M. Hennebique, only one-half of the lower bars extend horizontally for the entire length of the beams. The other half is found only at the center of the beams, along about one-third of their length and rise, at both ends, at such an angle as to reinforce properly the upper fibers above the supports. Besides the advantage of reinforcing the concrete, wherever it is subject to tension, without the help of additional rods, the bars so bent effectively resist all shearing stresses near the supports, where they are the greatest. On the other hand, this arrangement tends to lessen the compressive strength of the beams on the supports, which in certain cases may be detrimental. It is well also to note that the bars so bent are subject to tensile stresses along their entire length, and that, therefore, they tend to pull their extremities with all this concentrated effort, whereas straight bars are held by the adhesion distributed upon their whole length, and exert no pull, or very little, at their extremities.

To these few remarks, which refer alike to all deflected pieces, it is well to add a few words in reference to arches or floors.

Arches or floors carrying loads are generally reinforced only in a direction perpendicular to the direction of the beams. On the contrary, floors, such as street or bridge floors, which must carry heavy concentrated loads, are reinforced in two directions, perpendicular to each other. They are often divided into squares or slabs supported by two series of beams forming a grillage.

Transverse Reinforcements.—These reinforcements, the duty of which is to resist all shearing stresses, can be divided into three types:

1.—Vertical reinforcements, composed of flat or round iron wound in the shape of stirrups around the lower reinforcing bars.

2.—Bars alternately inclined at 45 deg. in two directions, as the diagonal members of a bridge truss.

3.—Bars inclined at 45 deg. but in one direction only ascending from the center toward the supports, that is, in the direction where the shear produces tension.

Theoretically, the last type is the most rational, but it is little used owing to the difficulty of keeping these inclined members in position during the concreting, when, after all, it is necessary to fasten their upper ends to horizontal metal bars generally doing no work whatever.

The second type adds to this trouble another, and that is the introduction of useless reinforcing members in the direction of the compression, which is easily resisted by the concrete. Vertical stirrups are used in France almost exclusively.

CALCULATION OF THE BENDING MOMENTS AND SHEARS.

In all armored or reinforced construction, this calculation is particularly difficult, owing to the fact that the component parts have become dependent upon one another, losing their identity in the whole. This solidarity of the component parts manifests itself in three distinct ways.

Longitudinal Continuity.—Floors, beams and girders are nearly always continuous over the supports. If they had everywhere an equal resistance to flexure, the stresses could be determined by the usual formulas for calculations of strength of materials; in other words, if a were the common length of the spans and p the uniformly distributed load per meter, the bending moment would be $^1/_{12}\ pa^2$ on supports and $^1/_{24}\ pa^2$ at the middle of the spans. But, in most constructions, the load bears only upon certain spans, and therefore the moment at a support may be much lower than $^1/_{12}\ pa^2$, whatever be the construction of the pieces, and the moment at the center of the spans may be much higher than $^1/_{24}\ pa^2$, so that the safety would be endangered in certain cases if the stresses were calculated by the above formulas. This is the reason why French designers assume that the safe minimum of the moment on the supports is only $^1/_{40}\ pa^2$, so that the resistance at the center must be based upon a bending moment of $^1/_{10}\ pa^2$. It is known that the moment would be $^1/_8\ pa^2$, if the fact that the beam is built in or fixed at both ends were neglected.

Distribution of Concentrated Loads Between Parallel Members.—This distribution depends evidently upon the relative values of the floors, slabs, or arches, of the beams and of the girders, and no general rule can be given. However, it is interesting to note that in the experiments made by the Commission for the study of reinforced concrete appointed by the Minister of Public Works in France, it has been discovered under various circumstances that the fatigue of beams or girders supporting concentrated loads was less than half what it should have been, were it not for the solidarity of similar and parallel members.

Width of Arches or Floors Strained by Concentrated Loads.—The Commission made no experiments in this instance. It is evident that the area of a floor containing two series of reinforcements perpendicular to each other, and strained—that is, under the influence of a load—depends upon the thickness of the concrete and the size of the reinforcements. For floors under roadways, having a thickness of 12 to 16 cm., it is generally admitted that concentrated loads can be uniformly distributed on a width of 1 m.

Participation of the Arches and Floors in the Deflections of the Beams.—The experiments of the French Commission were not made upon a sufficiently large number of constructions to permit final figures to be obtained; but, nevertheless, their results, give, perhaps, the most desirable and profitable data for the calculations. Very narrow floors or arches may be considered as being intimately united to and forming parts of the beams. The coefficient of participation is still 0.90 when the ratio of the spacing of the beams to their span is equal to 0.40, so that the width of the floor thoroughly conforming to the deformations of the beam is $0.90 \times 0.40 = 0.36$ of the span of the beams. If the spacing of beams increases beyond this limit, the effective work done by the floor does not increase much, and the equivalent width of floor does not seem to go beyond 0.40 of the span of the beams.

CALCULATIONS OF THE SIZES AND DEFORMATIONS OF REINFORCED BEAMS.

Formulas More Generally Used.—In calculating dimensions, M. Hennebique uses an empirical rule, which deserves a great deal of attention, owing to the very large number of constructions in which it has been successfully used. But some engineers who do not believe in using methods at variance with incontestable scientific principles, do not accept it because it is based upon the hypothesis of the inequality of the two opposite components of the couples of flexure. In practice, the result of the empirical formula mentioned above is to give, for tension and for parts subject to tensile stresses, values from 5 to 20 per cent. lower than those found with the other formulas.

It appears that M. Coignet was the first to publish in France a theoretical study of the strength of armored concrete, in which he applied to the calculations of bending stresses the hypothesis of the conservation of plane sections, which serves as the basis of the science and study of the strength of materials. He has neglected the tension in the concrete because it does not appear in fissures.

M. Christophe has taken up the same hypothesis in his important treatise, "Le Béton Armé et ses Applications" (Armored Concrete and Its Applications). He has corrected an error pertinent to the position of the resultant of pressures, and has taken 10 as the ratio of the coefficient of elasticity of metal and concrete. He very ably deduced from these hypotheses, formulas which apply to the various problems the designer has to solve.

Results Obtained and Consequences.—The writer thought advisable to study the properties of armored concrete, and, first of all, the effects of setting in relation to the volume; that is, its contraction, the internal stresses developed, and the production of fissures or cracks.

Afterward, he found that armored concrete when intact, or the concrete of blocks or portions separated by fissures, can withstand greater elongations than those which break ordinary unarmored concrete, and that, in these supplementary deformations, the coefficient of elasticity of the concrete is practically nothing.

He proved that the hypothesis of conservation of plane sections, although wrong in itself, gave results accurate enough to calculate all bending moments, except in the immediate vicinity of heavy concentrated loads.

In order to draw from these facts conclusions referring to the calculation of armored constructions, it is enough to recall the well-known fact that the coefficient of elasticity of concrete under compression decreases very much before rupture happens, especially in deflected beams where there is, before rupture, a decided shortening. This must be borne in mind in all calculations of resisting moments and breaking loads, and, consequently, of safe working loads proportional to this resistance or strength.

From this the following conclusions can be drawn:

Longitudinal Reinforcements and Concrete.—For preliminary calculations or deductions following the deformations, it is necessary to take into account the tensile stresses of the reinforced concrete, and the nullification of its coefficient of elasticity beyond the elastic limit.

For calculating the sizes, there is an added factor of safety in neglecting not only the uncertain help given by the tensile strength of the concrete to the resistance or strength of the reinforcing members, but also the fact that the neutral axis has been lowered, as a certain consequence of the tensions developed even in fissured concrete. One is thus compelled to adopt M. Christophe's formulas by giving to the ratio of the coefficients of elasticity a value equal to 15 or even 20, instead of 10, in order to take into account the diminution of the coefficient of elasticity of concrete compressed before rupture.

Transverse Reinforcements.—Some designers assume that the transverse or inclined reinforcements ought to resist alone the sum of all shearing stresses. Others think that for floors, slabs, or flat arches, almost invariably poorly reinforced, and resisting, in consequence, only low shearing strains, concrete and the longitudinal reinforcements are sufficient to take care of these strains without the additional help of stirrups. On the contrary, all designers seem to be of one accord in reinforcing transversely all beams, because the concrete filling does not always adhere to the floor girders.

Railway Signal Association.

The annual meeting of this association was reported in the *Railroad Gazette* of October 21, with the exception of the discussion of the standard specifications for manual interlocking machines and material, as proposed by the committee on that subject. The subject was found to develop so much discussion of details that the meeting got no farther than through the "General requirements." At the end of that chapter the report was laid on the table, with a view to continuing the discussion at subsequent meetings. Mr. Christofferson, the chairman, reported that he had been unable to get the members of the committee together for adequate discussion of the subject and that therefore the conclusions reported had been reached by correspondence. This naturally left many paragraphs in less finished form than would be desirable, and numerous points which could readily be settled in a committee meeting were brought up for discussion in the general meeting, so that the association practically spent two or three hours in "committee of the whole." The principal points discussed were the following:

The clause referring to free transportation of material was made to read *necessary* men, tools and material, some members having found that they had transported long distances for a contractor material used on another road. The proposition having been made that clauses which are liable to frequent change should be omitted from standard specifications, Mr. Ten Eyck suggested that the proper rule was to make the specifications as full as possible and have each clause so worded that the changes most frequently desired could be made simply by erasing words. Paragraph No. 4 was amended so as to read, "the purchaser will do all necessary *draining*, grading and blasting, and also provide all necessary permits for building tower." The association voted down a proposition to amend this paragraph so as to require the purchaser to furnish insulating rail joints and rail braces. Paragraph No. 8 was revised to read, "all threads must be United States standard unless variations therefrom are permitted by the purchaser. . . .".

It was voted that the fiscal year of the association shall hereafter end on September 30. President Mock appointed a committee to inquire into the efficiency of long burning lamps, and to report on the most suitable illuminating oils, of which Mr. C. C. Rosenberg (L. V.) is chairman. Mr. P. G. Ten Eyck (N. Y. C.) takes the place of Mr. Balliet as chairman of the Committee on Line Wires, Mr. Balliet having been chosen Secretary of the Association.

Steam Hammers vs. Drop Hammers for Pile Drivers.

Two reports, a majority and a minority report, were submitted on this subject to the Association of Railway Superintendents of Bridges and Buildings at the Chicago meeting. The majority report was, in part, as follows: The superiority of the steam hammer for some classes of work, such as foundation work under buildings, piers, etc., is apparent; while for road work, those who are using steam hammers would not exchange them for drop hammers under any circumstances. In the city of Chicago where, perhaps, more piles are driven for foundation work than anywhere else in the United States, steam hammers are used almost exclusively. The Illinois Central has steam hammers in use for foundation work and also uses them in driving falsework from the ground. They are said to have given most excellent service. The C. & E. I., the Santa Fe, and the Fort Worth & Denver all use steam hammers successfully in road work.

The committee believes the steam hammer is the best type of hammer for all kinds of pile driving, and when used with a bonnet makes pile driving a comparatively easy job. Piles can be driven without injury to the pile in almost any kind of earth with a steam hammer, where it would be rent from head to point by a drop hammer. The pile is held much more firmly under the steam hammer, and is guided home in much better fashion than can be accomplished with the drop hammer; besides there is not the injurious strain upon car and machinery that is felt from the drop hammer.

The cost of maintenance is much less for the steam than for the drop hammer, and the cost of driving piles is also much less. The first cost of the steam hammer is, of course, much greater, but it is a good investment notwithstanding.

The report is signed by O. J. Travis, Chairman; N. H. LaFountain, F. J. Leavitt, G. O. Lilly, H. Rettinghouse.

The minority report is by Mr. R. H. Reid, of the Lake Shore. He says: "I think for very hard driving, such as hard clay and hard pan, and in some cases for very soft driving, that the heavy drop hammer is the best, as it has enough energy in its blow to break the hold of the pile in the earth and force it down, where many times a steam hammer will not do this. I have seen a steam hammer bang away on the tops of piles until they were completely worn off and got so hot that they even took fire, but still would not go down. I think, also, that a drop hammer is more convenient to handle than a steam hammer, in a road driver, as the steam hammers are so very heavy that the driver needs lots of counter-weight to balance it when it is swung. Also, they are so long that very long leaders must be used in order to get piles under them, and with a heavy hammer at the top of the long leaders the machine is very likely to tip over on the track with much elevation or a track which is very much out of surface, as the tracks frequently are where work is being done. If I could only have one hammer for general railroad pile driving I would prefer a drop hammer to a steam hammer, as I think the work in general can be done cheaper, everything considered, with a drop hammer than with a steam hammer. I understand, of course, that a steam hammer is very desirable in some kinds of work, but for a single hammer I would prefer a drop hammer.

"In regard to using a bonnet with a steam hammer, this same piece of head gear can be used fully as well with a drop hammer, and will take up proportionately less of the energy of the blow of a drop hammer than of a steam hammer."

The following communication from Mr. A. S. Markley, of the Chicago & Eastern Illinois, was appended to the report.

During the past year the Chicago & Eastern Illinois bought a new pile driver from the Industrial Works, Bay City, Mich., with steam hammer. The hammer and frame complete weighs 5,170 lbs. The hammer alone weighs 2,840 lbs.; drop of hammer, 28 in. In a recent test made with this hammer it developed the following: Sixty-six blows for 1 ft. penetration with steam hammer, time 1 minute; 83 blows for 1 ft. penetration with steam hammer, time 1½ minute.

After making the above test the drop hammer weighing 2,900 lbs. was placed in the leads with a drop of 32 ft. with the following results: Twelve blows 1 ft. penetration with drop hammer, time 2 minutes; 10 blows 1 ft. penetration with drop hammer, time 2 minutes; 10 blows 1 ft. penetration with drop hammer, time 3½ minutes; 12 blows 1 ft. penetration with drop hammer, time 2½ minutes.

We then removed the drop hammer and replaced the steam hammer, with result given below: Two hundred and three blows 1 ft. penetration with steam hammer, time 3 minutes; 341 blows 9 ft. penetration with steam hammer, time 5 minutes.

These tests were all made on the same pile and at the same time just as quickly as the change in the hammers could be made.

With our experience in the past nine months with steam hammers there are several reasons why they are much better than the drop hammer. The effect is equal if not better than the drop hammer and requires no toggling; when the pile is once placed in the leads the hammer resting on it holds it in line, while with the drop hammer a great deal of toggling is necessary.

With the hammer we have a pile can be driven 7 ft. below the base of rail. With this arrangement, by using a little care, piles can be driven to their proper depth without being sawed off to put on the cap for temporary work. This we have done in a number of cases with good results and considerable time saved. In several cases where the piles after being driven the tops of which were of uneven surface, after the cap had been placed on them, the steam hammer was set on the cap, and pile driven so that the cap had a uniform bearing on all of them. With the steam hammer driving the top of piles below the rail, which cannot be done

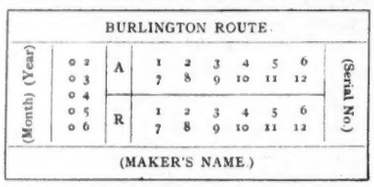
with any certainty with the drop hammer, there is from 2 to 3 ft. of pile saved on every pile driven, which in the course of a year means considerable saving, not only in the length of piles but in the hammer lines, piles, rings, and time.

In the test just referred to it required a great many more blows with the steam hammer to drive the pile 1 ft. than with the drop hammer, with the latter falling the full length of the leads, 27 ft. The piles were driven just as firm and penetration just as deep with the steam hammer as it could be done with the drop hammer. I believe everything is favorable to the former, with the additional advantage that the steam hammer does not damage the pile on the end and does not require it to be banded, which saves considerable money in this direction. It makes no difference where the head of the pile is in the leads with the steam hammer. It is just as effective one place as another. The longer the piles in the leads the less the drop of the hammer and less effect the hammer has on the pile. With our experience with the steam hammer we can drive four piles with it to where we can drive two with the drop hammer.

Specifications for Air-Brake Hose.*

The former M. C. B. standard specifications for air-brake hose, which were superseded by new specifications at the last convention of the association, called for a three or four ply hose to be made of a good grade of rubber and canvas, canvas layers to be strongly frictioned or cemented together and the inside rubber tube to have a high degree of stretch. The Burlington, not being satisfied with these specifications, drew up a different set, which called for a lower grade of rubber for the inner tube and friction layers between the canvas. This was done because experience on that road and elsewhere had shown that by far the largest proportion of hose was rendered unfit for service because of external mechanical causes and not through failures that might be attributed to the quality of materials used. The function of air-brake hose is to retain air under pressure without leakage, and to do this successfully the inner tube must be made of a fairly good grade of rubber without serious imperfections of continuity, the canvas layers must hold together reasonably well and there must be a sufficient number of layers to resist severe external mechanical usage, such as chafing, bruising, etc. Of course, other things being equal, a high grade of rubber is an advantage from a mechanical standpoint, but in practical the only real effect is to increase the cost of hose from 25 to 40 per cent.

In order to get more definite and positive information on which to base the new specifications, the Burlington made some laboratory and service tests of several brands of air-brake hose to determine, if possible,



Label for Air Hose, C., B. & Q.

the relationship between ordinary laboratory tests and service performance. For this purpose twelve lengths, each 122 in. long, of six different brands of air-brake hose were obtained, and one length of each brand was retained to make laboratory tests to represent the original condition of the material. The other lengths were applied to suburban passenger cars, each length having a brass tag fastened to it, showing its individual number and the following marking: "Test Hose No. ———. Return to Laboratory, Aurora, Ill."

Samples were called in at intervals of six months and subjected to the regular laboratory tests. The laboratory tests were the usual ones, consisting of determination of the friction of canvas layers, stretch of inside rubber tube, permanent set taken by rubber, bursting pressure and observations concerning the condition of the hose. The friction of the hose was determined by taking a section of hose 1 in. wide, placing it on a roller 1¼ in. in diameter and attaching a 25-lb. weight to a loosened end of the canvas. The friction was determined by the time it took for the weight to unwind a length of 12 in. The stretch of rubber was determined by measuring the length to which 1 in. of the inside tube, 1 in. wide, would stretch before breaking. This differs from the present method of making and expressing results of stretch in that at present a length of 2 in. is used, and the stretch is expressed in per cent. The permanent set was determined by first stretching the rubber to nearly its maximum length, releasing, and then placing gage marks 1 in. apart on it. The rubber was stretched to nearly its maximum length for ten minutes, released ten minutes, and the increase of length then measured. The bursting pressure was determined by means of water pressure, using a hand pump. The bursting pressure, friction and stretch are shown in Fig. 1. It will be noted that the original samples of the brands tested, range in friction from 1 second to 40 minutes, in stretch from 2½ in. to 7 in. and in bursting pressure from 650 to 825 lbs. per sq. in.

The most striking point shown by the plotted results is that, although some samples of hose have high initial friction, this friction dropped away quickly, and seems to bear no relation whatever to the bursting pressure which the hose maintains or to the stretch of the rubber. These results seem to indicate that just as good service may be expected from a hose having low friction and low stretch of rubber if the hose is substantially made, as can be expected from a hose giving high results in these two particulars.

From the results of these tests, covering almost three years, the Burlington drew up the following specifications for air-brake and signal hose, which are known as 15B, and are dated October 31, 1903. Hose is now being bought in accordance with them:

1. Air-brake and signal hose must be four-ply and the inner tube not less than 3/32 in. thick. Each length must be 22 inches (variations of ¼ in. being allowed) and capped with rubber, vulcanized on each end. The wrapping must be frictioned on both sides and must have a distinct layer of rubber between each ply.

2. The inside diameter of air-brake hose must be not less than 1¼ in. nor more than 1 5/16 in., and shall have enlarged ends as follows: For a space of 3 in. from the ends the internal diameter shall be not less than 1⅜ in. or more than 1 7/16 in. The inside diameter of signal hose must be not less than 1 in. or more than 1 1/16 in. and shall have enlarged ends as follows: For a space of 3 in. from the ends the internal diameter shall be not less than 1 5/32 in. nor more than 1 7/32 in.

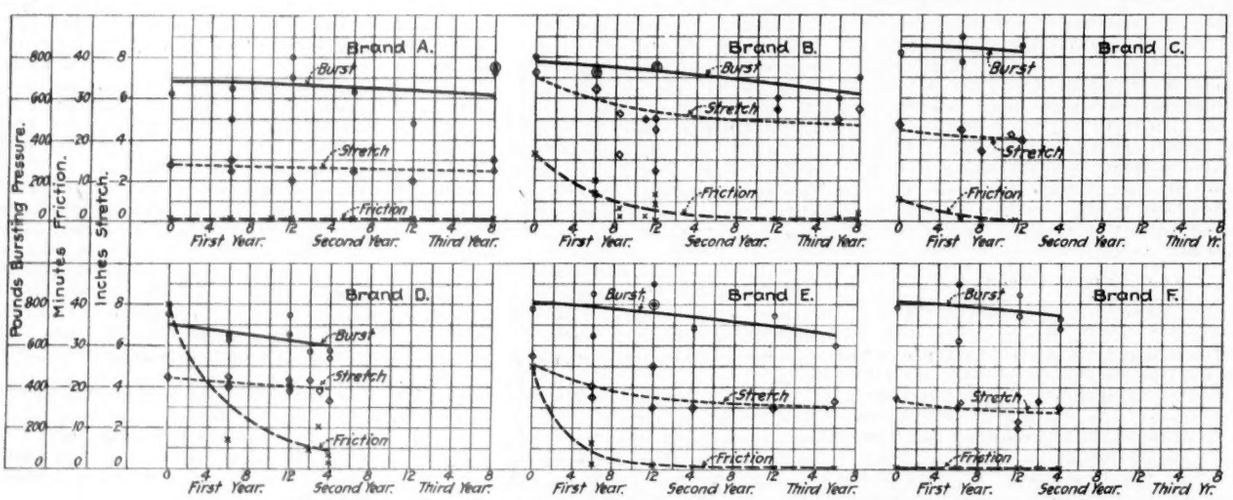


Fig. 1—Friction, Stretching and Bursting Tests of Air Brake Hose.

3. Each standard length of hose must bear label like the one shown below. In the left-hand space must appear the month and year of manufacture, in the right-hand space the serial number and in the bottom space the manufacturer's name. The figures enclosed are for use in marking the date of application and removal. The figures must be not less than 3/16 in. in height and stand in relief not less than 1/32 in., so as to be readily removed by cutting without endangering the cover tube.

4. Air-brake and signal hose will be ordered in lots of 200 or multiples thereof. Each lot of 200 must bear a manufacturer's serial number, commencing with 1 on the first of the year and continuing consecutively until the end of the year. For each lot of 200 hose ordered 201 must be furnished. On receipt of shipment one piece from each lot will be submitted to the following tests:

5. *Bursting Test.*—A section 3 in. long will be cut from one end of the test hose and the remaining 19 in. will be mounted on standard nipples and must stand an hydraulic pressure of 150 lbs. per sq. in., under which pressure it must not expand more than 3/16 in. in diameter, and subsequently must stand 500 lbs. hydraulic pressure per sq. in. for ten minutes without bursting.

6. *Stretching Test.*—A section of the inner tube.

*Abstract of a paper read before the American Society for Testing Materials at Atlantic City, N. J., June, 1904, by M. H. Wickhorst, Engineer of Tests, C., B. & Q., Aurora, Ill.

1 in. wide will be stretched 300 per cent. and then immediately released. Marks 2 in. apart will then be placed on it, the rubber stretched 300 per cent., or so the marks are 8 in. apart, held for ten minutes, then released for ten minutes and elongation noted. The rubber must stretch 300 per cent. for ten minutes without breaking, and must not take a permanent elongation of more than ¼ in.

7. Material failing these requirements will be rejected and disposed of as manufacturers may direct at their expense.

It will be noted that the Burlington specification differs materially from the former M. C. B. specifications in the following particulars:

First—It requires no test for friction of canvas.

Second—Instead of calling for stretch of 400 per cent., it calls for only 300 per cent.

Third—The bursting pressure is about the same.

In order to fully meet the M. C. B. requirements, a much higher grade of rubber is required in the inner tube and between the canvas layers than is necessary for the service to which the hose is put, resulting in an increase of cost to the railroad company of from 25 to 40 per cent., with apparently but little if any increased service from the hose.

The Burlington has been buying hose to its own specification since January 1, 1903, and in order to have some fairly definite information as to the performance of specification hose, a record was started of all such hose removed from service. All hose removed from the C., B. & Q. R. R. division of the Burlington System is shipped to the store at Aurora, Ill. When received here it is looked over by a laboratory inspector and record made of each length of hose on a card form 3 in. x 5 in., as shown below:

Air Hose Failures.

Maker, Class, Most Serv., Date Made, Serial No. In serv., Out serv., Rec'd at Lab. A. B. or Sig., Descriptive of failure,

Instructions for making out this record and tabulation of the results are as follows:

BURLINGTON ROUTE LABORATORY, AURORA, ILL.

Air Hose Failures.—Methods of Keeping Records and Tabulating Statistics.

1. For each sample of failed air-hose received at the laboratory or Aurora Store fill out a printed card 3 by 5 in. provided for the purpose.

2. Hose failures should be classified as follows:

Due to External Causes. Due to Quality of Hose:

A—Torn apart.
B—Chafed.
C—Cut.
D—Bruised at nipple end.
E—Bruised at coupling end.
F—Kinked.
G—Unclassified.
H—Defective inner tube.
I—Defective outer covering.
J—Defective wrapping.
K—Unclassified.

3. The cards should be classified in the file as follows:

First.—By periods of time, *e. g.*, one year.
Second—By maker.
Third—By class of failure.
Fourth—By months' service, using periods of two months. For example, a hose giving three months' service should be classified as four months' service.

4. At the end of each year or such period as may be desired the statistics should be tabulated on a tracing made for the purpose.

This record has been kept since October, 1903, and the results so far developed are shown below:

TIME IN SERVICE.

	Class of Failure.	2 m.	4 m.	6 m.	8 m.	10 m.	1 y.	1 y. 2 m.	Total.	Per Cent.	
External Causes.	A. Torn apart	9	11	12	6	4	..	..	42	8.35	Total, 464. Per cent., 92.25
	B. Chafed	6	20	17	11	7	7	2	70	13.9	
	C. Cut	1	4	3	3	1	..	..	12	2.38	
	D. Bruised at nipple end	29	64	46	24	15	3	1	182	36.2	
	E. Bruised at coupling end	6	15	12	5	6	2	..	46	9.13	
	F. Kinked	1	8	31	21	15	3	..	79	15.7	
	G. Unclassified	8	10	5	4	4	2	..	33	6.55	
Quality of Hose.	H. Inner tube	..	..	..	..	..	..	..	..	..	Total 39. Per cent., 7.75
	I. Outer cover	..	3	9	14	6	2	..	34	6.75	
	J. Wrapping	..	..	1	1	..	..	..	2	.39	
	K. Unclassified	1	..	..	..	2	..	..	3	.59	
	Total	61	135	136	89	60	19	3	503	99.9	

This record has not been kept long enough to draw conclusive evidence from, but it seems to show fairly clearly that the great bulk of hose is removed on account of being rendered unfit for service by external mechanical causes, apparently largely due to abuse by trainmen. For instance, failures due to Class A, "Torn Apart," are undoubtedly largely cases where the brakeman has failed to uncouple the hose. Failures due to Class D, "Bruised at Nipple End," show 36.2 per cent. These apparently are cases where the brakeman finds the angle cock hard to turn and uses his heel or a piece of iron and accidentally hits the hose at the nipple end, bruising and weakening it at this point. Where hose fails due to material giving out, it is almost always due to unwrapping of the outer covers. This apparently would argue for high friction, but it will be noted that the percentage of failures from this cause is not great, and as shown above, even where hose has high initial friction, this quality is short-lived.

In order to determine how long a sample of hose retains its friction when kept without being put into service, samples were retained in the laboratory as shipments were inspected, making determinations of friction, stretch of rubber and set of rubber at intervals of three months. The results of the determination of friction are shown below:

Sample.	25 Pounds Unwinds 12 in. in Original.	3 Months.	6 Months.	9 Months.	12 Months.
1	40 hrs.	3 hrs. 15 min.	17 min.	4 min.	11 min.
2	4 hrs.	4 hrs.	17 hrs.	11 hrs.	3 hrs. 30 min.
3	15 hrs. 45 min.	20 min.	10 min.	7 min.	7 min.
4	2 hrs.	25 hrs.	35 min.	15 min.	40 min.
5	7 hrs. 30 min.	3 min.	2 min.	2 min.	
6	6 hrs. 35 min.	1 hr. 20 min.	40 min.	12 min.	
7	11 hrs.	1 hr.	40 min.		
8	13 hrs.	4 hrs.	40 min.		
9	3 hrs.	51 min.	26 min.		
10	45 hrs.	10 hrs.	7 hrs. 30 min.		

From this it will be noted that all the samples show a loss of friction after three months; most of them losing almost all friction in six months, although in some cases the friction is retained somewhat longer.

In this connection it will probably be of interest to include some figures as to the amount of hose used per car per year, compiled by G. G. Yeomans, Purchasing Agent of the Burlington. Figures were first obtained from the purchasing agents of a number of roads on which climatic conditions were about the same as the Burlington and of the number of feet of hose bought exclusively for repairs covering a period of two years. He also obtained independently from the mechanical departments, the average number of all classes of air-brake equipment covering passenger cars, locomotives, freight cars, etc. From this he has figured the number of feet of hose used per car per annum for repairs. These roads were using different qualities of hose, and the results are shown below:

Road.	Price of Hose.	Feet Per Car Per Year.
Burlington	Medium	1.47
No. 1	Medium	1.51
No. 2	High priced	1.30
No. 3	Cheapest	3.35
No. 4	Part cheap, part medium.	1.85
No. 5	Cheap	2.14

From the table it would seem that, while hose cheap in price is dear in net results, on the other hand, hose high in price is likewise not the most economical.

Travelers for Erecting Steel Bridge Spans Up to 200 Feet.

The best form of traveler to be used in erecting steel railroad bridges of spans up to 200 ft. furnished one of the most interesting subjects for discussion at the recent meeting of Superintendents of Bridges and Buildings in Chicago. The committee having the subject in charge reported as follows:

After considering in a general way the methods followed by different railroad companies and contractors in the erection of bridges of less than 200 ft. span, it was decided that in order to cover the field fully, inquiries must definitely include derrick cars and similar equipment, as well as the type usually called travelers. The replies received to inquiries sent out represent railroads having a total of about 90,000 miles of main line. Those companies which are definitely committed to the erection of steel bridges with their own men and equipment comprise lines covering about 55,000 miles. Those companies which have contractors do their erecting, comprise lines having a total mileage of about 30,000 miles. More than 60 per cent., therefore, of the mileage represented by the replies received is committed to the policy of erecting its own bridges. In many cases the companies which do their own erecting limit this practice to girder bridges and in some cases to the short girders. This limitation, however, does not apply to a large percentage of the total mileage. It is found that out of the 90,000 miles represented by replies received, something over 35,000 miles apply to systems which erect all their own steel bridges.

The use of derrick cars is quite generally advocated in the replies received, but the extent to which they are used varies according to circumstances. The Chicago & North Western, the Illinois Central and the Chicago, Burlington & Quincy, representing a total of approximately 15,000 miles of line, have practically adopted the derrick car as the best equipment for erecting all classes of steel railroad bridges under 200 ft. span. This means not only girder bridges, but through truss bridges as well.

The drawings and photographs which the committee has accumulated indicate that there is very little choice between one overhead traveler and another. They also indicate that, so far, at least, as essential elements are concerned, there is very little difference between one derrick car and another. It would, therefore, appear that any discussion of the subject must be primarily a discussion of the comparative merits of derrick cars and through travelers. The following is a summary of the points which have been given consideration by the committee:

(1) Adaptability. Years of experience have shown the overhead traveler to be perfectly adapted to the erection of through and deck bridges. Its general type is well-known and simple. It is generally conceded, how-

ever, that the derrick car is better fitted for erecting girder bridges.

(2) Interference with Traffic.—It is claimed by the advocates of the overhead traveler that this type of rig interferes less with traffic and is, therefore, preferable for use on lines where trains are frequent. A derrick car, in order to meet the requirements placed upon it, must be self-propelling and if the turnout has been constructed in close proximity with the bridge, the interruption of traffic should not be much, if any, greater than that occasioned by erection with an overhead traveler. A self-propelling derrick car will, in many cases, take the place of a work train and result in less interference to traffic for that reason.

(3) Cost of Preliminary Preparations.—The additional cost in case of an overhead traveler is represented by the extra width of falsework to provide a runway for the traveler, and by the cost of erecting and taking down the rig. The extra cost in case of derrick car consists of the provision of spur track at the site for the use of the car.

(4) Economy in Operation.—No reliable information regarding costs was obtained by the committee. Its opinion is that in the erection of girder bridges and trestles a derrick car is by far the cheapest form of rig to be used; and for the erection of truss bridges a derrick car is, to say the least, no more expensive in operation than an overhead traveler.

(5) Permanent Investment.—As a permanent investment the overhead traveler is much less than the derrick car, but the derrick car can be used in so many other ways when it is not engaged in the erection of bridges that it is found by those who have used it to be a most valuable tool to have in the department.

The report is signed by G. W. Smith, Chairman; Moses Burpee, George J. Bishop, A. O. Cunningham, J. C. Hain, I. F. Stern.

General Passenger Agents.

The forty-ninth annual meeting of the American Association of General Passenger and Ticket Agents was held at Fort Monroe, Va., October 19 and 20. The election of officers resulted in the choice of Mr. F. E. Boothby (Maine Central) as President for the ensuing year; A. J. Smith (L. S. & M. S.), Vice-President, and Messrs. T. W. Lee, W. L. Ross and Charles Cleland, members of the executive committee. Mr. A. J. Smith, the veteran Secretary, declined re-election, and C. M. Burt (Central of New Jersey), of New York City, was elected to succeed him.

Among the communications from other associations was one from the Traveling Passenger Agents, by Mr. G. G. Noble, South Eastern Passenger Agent of the Lehigh Valley, Philadelphia. This report tells us that—

> The power to make friends and to form an acquaintanceship immediately is most indispensable to the successful traveling passenger agent. Personal friendship is the principal stock in trade he has to-day. In the days of the old quarter-sheet and old-fashioned colonist movements, when the traveling passenger agent performed nearly all of his transactions through the local ticket agent, I am told that it was not deemed essential for him to be on intimate terms with the passenger. This is not the case to-day. The traveling passenger agent must be personally acquainted, not only with every local ticket agent and every passenger representative of foreign lines in his district, but he must have a host of friends in every city, town and village in his territory. He should be on intimate terms with the business and professional men and be well acquainted with the newspaper fraternity throughout his territory. A general passenger agent of one of our largest roads made a statement not long ago that it was advisable to change traveling passenger agents from one territory to another to prevent them from becoming "rusty." But if a traveling passenger agent becomes rusty in one territory he will soon get that way in another.

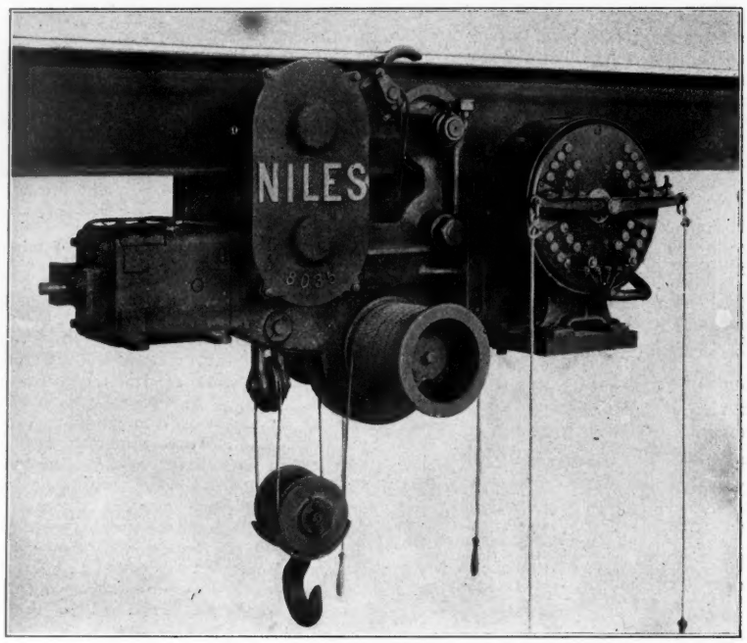
When the meeting took up the resolution to abolish or restrict the business of Sunday excursions, a large number of telegrams and letters were produced from religious organizations in all parts of the country. Secretary Smith said that the better element of the entire country was protesting against the desecration of the Sabbath and demanding that employees be given a regular rest day. The charges of Sabbath desecration appear to be based to a considerable extent on the experience of some country towns which have been flooded with undesirable and lawless crowds from large cities, brought out on one-day excursions. A representative of the Michigan Central said that his road had for years refrained from running Sunday excursions, but had been obliged to enter the field under pressure of competition. The business produces about $150,000 a year, but the company is ready to discontinue it whenever the other lines will join in the movement. The General Passenger Agent of the Maine Central opposed the resolution on the ground that Sunday recreation is demanded. Mr. Hardwick, of the Southern, made a plea for Sunday observance. He said that his road had discontinued Sunday excursions; this on moral grounds and also because of the feeling that they did not pay. "I have still the old-fashioned idea of the Sabbath day," said Mr. Hardwick. He held that the running of Sunday excursions was purely a local line matter, and largely one of particular locality. He said that as a general proposition the Southern did not encourage Sunday excursions, and furthermore, these were prohibited to some extent in certain States in which the company's lines run; that personally and officially he did not believe in encouraging Sunday work, or overtime at the office, at night, or on holidays; that the men were all the better for having these periods of rest and recreation for their own enjoyment. At the same time a certain amount of Sunday work, including some Sunday excursion traffic, he believed required by the public; it is in itself helpful to the public; but these were matters which could not be legislated upon in any general or blanket-like rule, and the matter therefore could only be dealt with by each line for itself.

No decisive action was taken, the question being referred to the several local traffic associations.

A New Electric Traveling Hoist.

The Niles electric traveling hoist shown in the accompanying illustration is made by the Niles-Bement-Pond Company, New York, in sizes ranging from three-quarters of a ton to six ton capacity. It can be used either as a hoist or a small capacity crane. When used as a hoist it is run on an I-beam track and when used as a crane it is mounted on a traveling bridge and is arranged to run between the two I-beams or channels of the bridge. The controllers for raising and lowering the hook and operating the traversing mechanism can be placed either on the hoist, on the bridge and operated by cords from the floor, or in an operator's cage attached to the bridge.

When used on an I-beam, the controllers are attached to the hoist and are operated by cords from the floor. This hoist will run on straight and curved tracks, and it is usually provided with a separate motor for traversing, but if desired, hand traverse can be furnished, or all the traversing mechanism may be omitted and the trolley moved along the track by pushing on the load. The increased service of the electric traverse, however, much more than compensates for the slight additional cost.



A New Electric Traveling Hoist.

The hoist is self-contained in a heavy cast-iron frame to which the motors are attached end on, and the power is transmitted directly from the armature shaft to the drum shaft through a train of worm wheel gears.

The traversing mechanism is also driven through a train of worm and worm wheel gears similar to the hoisting mechanism, except that when the trolley is arranged to run on a single I-beam, a double set of transmission gears is used to connect the worm gear shaft to the truck wheel shafts. All the mechanism is enclosed in an oil and dust proof casing and is noiseless in operation.

In addition to the braking effect obtained by the use of the worm and worm wheel, an electric brake is attached to the hoist motor.

GENERAL NEWS SECTION

THE SCRAP HEAP.

The block system is now in use throughout the lines of the Chicago & North Western and the Chicago, St. Paul, Minneapolis & Omaha from Duluth to Chicago and from Duluth to St. Paul.

On one day last week the St. Louis Southwestern carried out of St. Louis a party of 760 "farmers and capitalists" from the East, said to be the largest party of homeseekers or investors ever taken to the southwest at one time.

The Supreme Court of Florida, in a suit brought by the State Railroad Commission, has issued peremptory mandamuses directing the railroads of the State to carry phosphate to all seaports of Florida at one cent per ton per mile. The Fernandina Board of Trade had complained that the rates to Savannah were unduly low, as compared with those to Florida ports.

For the annual meeting at Chicago last week, the Illinois Central Railroad issued free passes to about 850 stockholders. Since the adoption, a few years ago, of the rule permitting stockholders to ride to the annual meeting without charge, a considerable number of persons in Mississippi and Louisiana have bought one share of stock apiece. As the fare from those States to Chicago and back is 40 or 50 dollars, the stockholder receives a very handsome dividend.

During the fiscal year ending June 30, lumber exports from Gulfport, Miss., have exceeded those of any other gulf or Atlantic port. Hitherto Pensacola has been the largest exporter of lumber, but this year Gulfport exported 193 million feet of lumber, as against 174 million from Pensacola. This places Gulfport at the head of the southern ports and second in the United States only to Puget Sound. The rapidity of the growth of its foreign business is shown by the fact that lumber exports have increased from 47,000,000 ft. in 1903 to 193,000,000 ft. in 1904.

The heavy movement of wheat from the States of Washington and Oregon to the East, which was noted in these columns recently, is said to have been checked by the lack of a sufficient supply of freight cars, and the men who have been buying this wheat have stopped their purchases. One account says the quantity bought amounts to from 12 to 15 million bushels. Prices at Liverpool have been so low, as compared with those in the eastern part of the United States, that Pacific Coast shippers have tried to send wheat to New York by sea, but have been unable to find vessels.

The Railroad Commissioners of Alabama in their annual report, which has just been sent to the Governor, congratulate the citizens of the State on the fact that the cities of Alabama enjoy more favorable rates from the Ohio and Mississippi crossings than do the cities of Georgia or other adjacent States. The commissioners have had urgent requests to order reductions of freight rates within the State, but these have in most cases been refused because of the belief that, as the railroads are not earning more than a fair income, any reductions made in Alabama would have to be accompanied by increased rates from points outside of the State.

An officer of the Grand Trunk says that the tragedy in the Sarnia tunnel, reported October 14, page 451, where six employees of the road were suffocated by gas, was caused by the mistaken sense of duty which led a number of the men to take great risks. It was a demonstration of remarkable heroism on the part of men who took pride in doing their duty at all hazards. The men at one time were all clear of the tunnel, and might have stayed out if they had not been determined to stick by their train. The tunnel gas gave little warning of its effect, but both Engineer Coleman and Conductor Simpson were warned not to remain in danger. Conductor Tinsley perished because he insisted on staying by his friend, Simpson. Switchman Blake on going into the tunnel, climbed over the bodies of the driver and fireman into the cab of the engine, and took the train out, picking up the stricken men as he went along. No one knew before that Blake could run an engine, as he had been employed as a switchman.

A New Incandescent Lamp Socket Ring.

A new incandescent lamp socket ring known as the "Electrobestos" is made by H. W. Johns-Manville Co., 100 William street, New York. It is claimed that this ring is fireproof and that it is practically non-breakable. It is also claimed that its non-conducting properties have been established in a break-down test of 2,000 volts.

Allis-Chalmers' World's Fair Awards.

The jury at the St. Louis World's Fair has given to the Allis-Chalmers Company, for its exhibits of steam, electrical and mining machinery, the three highest awards. The exhibits included a 5,000 h.p. engine and a large generator built by the Bullock Electric Manufacturing Company, each of which won a grand prize. These two machines supplied the current for the decorative lighting of the Exposition buildings and grounds. The Allis-Chalmers exhibit was also awarded a grand prize in the Department of Mines and Metallurgy. This mining exhibit included rock and ore breakers, a concentrating table, crushing rolls, ball and tube mills and a heavy six-foot mill. The Bullock Electric Manufacturing Company's prize was for alternators, motors and rotary converters. In addition to this, the Bullock system of multiple-voltage control of motors won a gold medal.

Unlimited Facilities on the California Limited.

The Atchison, Topeka & Santa Fe informs an anxious and expectant world that on the California limited trains of that road, between Chicago and Los Angeles and San Francisco, gentlemen may now have their trousers pressed by the porter while they wait; or, rather, while they sleep. This is a new wrinkle—or, rather, we should say a crease—just introduced "for the benefit of fastidious dressers." Another luxury furnished on this train, less important, of course, than the foregoing, is a daily telegraphic market report, and people who care neither for genteel clothes nor the excitements of Wall Street may promote happiness and longevity by using a Whitley exerciser. Incidentally, it is announced that on and after November 13 this train will be run every day in the week.

A Proposed Railroad in Haiti.

A consular report from Haiti says that a concession has recently been granted by the Haitien Government to Messrs. Lewis Dalmas and E. A. Blanton, Jr., to build a railroad from Gonaives, a port in the northwestern part of the republic, to Ennery, and thence to Hinche. This is the most important concession ever granted to foreigners, as heretofore all propositions for building a railroad into the interior have been rejected by the government. The proposed railroad will pass through a region which is said to be rich in minerals, including copper, silver, gold and iron, and will penetrate ebony, cedar, pitch pine and white walnut forests. There is already on the island a railroad built by citizens of the United States; it was completed about a year ago from Port au Prince to the lakes, these lakes being a part of the boundary between the republics of Haiti and San Domingo.

Texas Railroads.

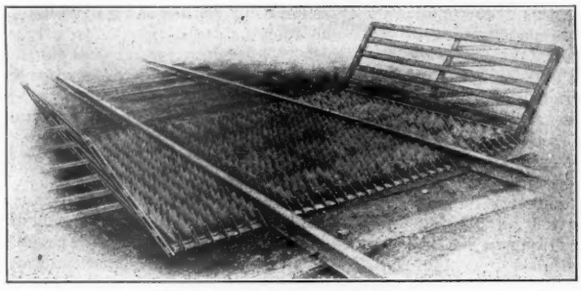
Railroad Commissioner O. B. Colquitt, of Texas, in an address delivered recently at Austin, said that the average indebtedness of the railroads of Texas had been reduced materially in the last ten years. For the whole State the average amount of stock and bonds per mile in 1894 was $40,802; on June 30 of the present year it was $32,581. The average amount of bonds per mile of road is now $21,281. Mr. Colquitt claims for the Railroad Commission a good share of the credit for making the reduction in inflated securities implied by this statement. He denied that there was any intention to have the present laws amended so as to allow a revaluation of certain railroads whose bonds will soon fall due; only two railroads are to pay off bonds before 1909, and the bonds to be paid are provided for. The Commission refused to assent to a trackage contract by which the Southern Pacific and the Rock Island were to use a certain length of road jointly, on the ground that the roads named were equal owners in the holding company that owned or controlled the line and such common ownership of stock was a violation of the section of the Constitution prohibiting the consolidation of parallel and competing lines.

Missouri Pacific Farmers' Instruction Car.

The agricultural exhibit and instruction car which the Missouri Pacific is now showing in the large towns along its lines, and which was noticed in the *Railroad Gazette* of October 14, is designed primarily for the purpose of advertising the resources of Missouri Pacific territory in the Central and Eastern States, and the present journey along the home lines is made for the purpose of getting more thoroughly in touch with the farmers, and learning their needs and purposes, before undertaking to advertise them to the world. When the car is about to visit a given county seat, circulars are sent out inviting the farmers and citizens to come to the meetings that are held, with a view to exchanging information and increasing knowledge as to the crops best adapted to the soil and climate in that region. Evidently, such missionary work as this can hardly fail of a high degree of success, and it is expected that the work of the government and State experiment stations in the southwest will be stimulated and benefited by what is being done. An officer of the Missouri Pacific says that he already has assurances that 300,000 fruit trees will be planted along the company's lines this fall and next spring. The lectures delivered at the meetings held in the car are given, in each case, by men well acquainted with that particular territory.

The Cook All-Steel Cattle-Guard.

The Cook all-steel cattle-guard, which has now been in use 12 years, is shown in the accompanying illustration. The advantages claimed for it are simplicity of construction, ease of installation and effectiveness as a "stock turner." The guard is made in four interchangeable sections, requiring no preparation of track, except to space the ties at the ends of the guard so that it will rest on the end ties only, hanging clear of the intermediate ties underneath. This permits the guard to vibrate under weight, and this feature, combined with the sharp teeth, alternating in height, discourages attempts of animals to cross. To prevent stampeded animals, going at full speed, from leaping across, a 4-ft. section can be added to the length of the guard, thereby making it 12 ft. 3 in. long. This long stretch of guard, it is claimed, arrests the attention of the animals, and presents an appearance of danger that is, in effect, the same as the old-style pit guard, in which the prominence of the obstruction was considered to be its chief virtue as a stock turner.



The Cook All-Steel Cattle-Guard.

This guard is made by the Merrill-Stevens Company, Kalamazoo, Mich. This company has an exhibit at the World's Fair in the Transportation Building, aisles C and 4, which includes besides sample cattle-guards, ten sizes of "Standard" track and car jacks, which this company also makes.

Bids for Building a Street Railroad in Shanghai, China.

Bids are wanted by the Secretary of the Municipal Council, Shanghai, China, on or before March 31, 1905, accompanied by a deposit of $25,000 or security to that amount, for building and operating about 24 miles of electric (trolley) railroad in the streets of Shanghai. Alternative proposals are wanted for single trolley and double trolley lines. The agents of the company, from whom copies of the proposed contract and other information can be obtained, are John Pook & Co., 63 Leadenhall street, London, Eng., and Fearon, Daniel & Co., 96 Wall street, New York.

The Public and the Labor Unions.

In an address on the relations of the general public to organized labor, delivered at the Trans-Mississippi Congress in St. Louis, October 27, Mr. F. B. Thurber, of New York, took the very effective course of giving extracts from the daily newspapers, which he reprinted by the dozen, with fac-simile headlines, telling of the murders and other violence committed by and on behalf of strikers in various cities of the country during the past year or so. How many of these extracts were actually read by Mr. Thurber we do not know, but the point is immaterial, for the extracts accomplish their purpose most effectively when read from the pamphlet copy of the address, which, we suppose, was circulated among the people attending the convention. As the reader will readily understand, from what he has seen of similar exhibits published in the *Railroad Gazette* a few months ago, such a collection of serious and significant facts makes a most effective presentation of the subject under consideration. Mr. Thurber, in closing, said: "Organized labor represents less than 20 per cent. of all labor, yet it assumes to dictate to all labor and the public generally. All good citizens desire that all labor shall share equitably in the profits of production, but when a minority organizes itself into a 'trust,' terrorizes non-union workmen, boycotts tradesmen, denounces the police and the National Guard, and threatens legislators and judges with the displeasure of organized labor, the public, whose interests are disregarded and sacrificed, should take a hand in settling this strife on a basis equitable to all concerned, and especially sustain legislators and officers of the law who do not yield to the demands of any one class. Conciliation and arbitration, as palliatives, are all right as far as they go, but law and order are basic requisites, and independent legislators, judges, the police, the military, and other executives, must be sustained alike in the interest of labor, of capital and of the general public. 'A fair day's pay for a fair day's work' has been changed by many labor unions into 'How much can we hold up the boss for?' They never think of the general public, including themselves, and seem to be willing to kill the goose that lays the golden eggs."

Delaware, Lackawanna & Western Shops at Kingsland, N. J.

The Delaware, Lackawanna & Western is putting up four buildings to enlarge its shop plant at Kingsland, N. J., as follows: Paint and coach shop 170 ft. x 660 ft., with a lean-to at paint shop end 50 ft. x 264 ft., paint and coach shop annex 70 ft. x 300 ft., and paint and oil storage house 40 ft. x 268 ft. The power house, for which plans have not been completed, will be 62 ft. x 200 ft., and the locomotive shop to be built next year will be 126 ft. x 608 ft. All of the buildings will be of one story, 22 ft. high, with steel trusses and purlins and reinforced concrete roof plates 3 in. thick. The contract for the reinforced concrete work has been let to Merritt & Company, of Philadelphia, Pa.; all the steel work was made by the McClintic-Marshall Construction Company, and a large part has been delivered. E. S. Williams, of Scranton, has the contract for laying the vitrified brick for the outside, also for the fire walls, and the stone sills and coping are furnished by the F. G. Clarke Blue Stone Company, of Oxford, N. Y. A contract has been given to The Stirling Company, Chicago, Ill., for six 240 h.p. boilers for the power house. There will also be a transfer table 70 ft. x 700 ft., contract for which has been given to Nichols Brothers, of Chicago, Ill. The railroad company will do all the construction work on these buildings except the work mentioned above, which has been let by contract. The buildings will be heated by the fan system; the intention is to use exhaust steam for heating, with a vacuum system. All engines, dynamos, motors and equipment will be ordered by Mr. R. F. Kilpatrick, Supt. M. P. & E., Scranton, Pa.

Manufacturing and Business.

The Baldt Steel Co., of Newcastle, Del., has increased its capital stock from $250,000 to $375,000.

The Erie Heating Company, Chicago, has moved its offices from 34 and 36 West Monroe street to the second floor of the Railway Exchange.

The Louisiana Purchase Exposition has awarded the Boston & Lockport Block Co., Boston, Mass., a gold medal for its improvements in tackle blocks.

The Steam Superheater Fuel Co., of New York, has been incorporated in Delaware with a capital of $250,000 to make and sell steam generators and heating apparatus.

An announcement has been made that the grand prize at the St. Louis World's Fair for pressed-steel car construction has been awarded to the Pressed Steel Car Co., of Pittsburg, Pa.

Bids are wanted November 26 at the United States Engineers office, Jones building, Detroit, Mich., for building one steel vessel. Information will be furnished by Charles E. L. B. Davis, Lieut. Col. Engineer.

The car barns of the Boston Elevated at Forest Hills, Mass., were damaged by fire October 24 to the extent of about $150,000, and a conductor was burned to death. The fire is supposed to have been caused by a broken electric wire.

The Wagner Manufacturing Co., of New York has been incorporated to make machinery with a capital of $500,000. The directors are: Thomas J. Creamer, A. Alexander, Nicholas A. McManus, Henry P. Morrison, Edward A. Alexander, Edward M. Muller, of New York city, and James A. Ross, of South Middleton, Mass.

"Thermit," made by the Goldschmidt Thermit Co., 41 Wall street, New York city, has been awarded the grand prize at the St. Louis World's Fair. Mr. Carr, the representative of the company, gives daily demonstrations of welding in the southeast corner of the Mines and Metallurgy building. The company has lately received orders for welding rails on electric railroads in a number of American cities.

The American Locomotive Company has been awarded the grand prize for its exhibits at St. Louis and collaborators' grand prize gold medals were given to the following men who helped to make the display: James E. Sague, Vice-President; John Player, Consulting Engineer; Charles J. Mellin, Designing Engineer; F. J. Cole, Mechanical Engineer, and James McNaughton, General Superintendent of the Schenectady and Brooks Works.

The Exeter Machine Works at West Pittston, Pa., maker of machinery, has about completed plans for enlarging its works to double their capacity. The works now cover nearly a block on Montgomery street and an additional piece of ground about 250 ft. square on the opposite side has been bought to be used for a new boiler and engine room and for an electric plant. The extension to the machine shops will be 175 x 180 ft., two stories high. The works are now running on double shift.

Power was turned on in the new Pere Marquette shops at Grand Rapids, Mich., October 15th, for the first time. Some of the motors and line shafting were started up to drive such of the machine tools as have been installed. The entire plant, including the layout and buildings, with the complete light, heat, water, compressed air and electric power system was designed by the Arnold Electric Power Station Company, Chicago. Record time was made in executing the contract, as the plans were not started until the middle of April.

The Westinghouse Electric & Manufacturing Co. announces the appointment of Mr. Clement F. Street as Commercial Engineer. Mr. Street's work will be chiefly in connection with steam railroads, a field in which his long and varied experience gives him exceptional qualifications. After working in a number of engineering establishments, Mr. Street was for four years chief draftsman in the motive power department of the Chicago, Milwaukee & St. Paul, and then for seven years was one of the editors of the *Railway Review*. In 1894 he went around the world in the interest of the Field Columbian Museum. Subsequently he was with the Dayton Malleable Iron Company and the Wellman-Seaver-Morgan Company, and he now resigns his place with the latter company to go to the Westinghouse Company.

Iron and Steel.

The Lackawanna Steel Co., according to reports, will probably buy from 30,000 to 40,000 tons of Bessemer pig iron for its large steel works at Buffalo.

The Carnegie Steel Co. (United States Steel Corporation) has many orders for light rails to be delivered this year and the mill at the Edgar Thomson Works has been started on double runs. This demand for light rails is the heaviest during the past two years. The Standard rail mill of the Thomson plant has also been operating on night and day runs to fill the rail contracts which call for immediate delivery.

The annual report of the Republic Iron & Steel Company makes a disappointing showing owing to the depression in the industry and decline in prices. The net profits for the year were $1,306,068. The sum of $1,560,256 was charged to reconstruction, repairs, depreciation, etc., showing a net loss of $254,188 for the year. The President says that the business has been operated on a paying basis for the past three months.

The directors of the United States Steel Corporation on October 25 announced net earnings for the quarter as $18,773,932 and unfilled orders on hand of 3,027,436 tons. The chairman said that orders for steel products are coming in at the rate of about 26,000 tons a day, which is an increase of 30 per cent. as compared with the bookings in October a year ago. The net earnings compare with $19,490,725 in the June quarter and with $32,422,955 in the September quarter of 1903.

At the annual meeting of the Crucible Steel Co. in Jersey City, October 19, the President's report asked the stockholders to authorize an issue of $7,000,000 first-mortgage 5 per cent. bonds for the $5,000,000 short-term 6 per cent. collateral trust bonds issued in 1903, and to cancel other obligations of the company amounting to $940,000; also to buy the outstanding stock of the Park Steel Co. amounting to $235,100. The issue was unanimously authorized by the directors. For the year ending August 31, net earnings of this company were reported as only $488,160, in consequence of the heavy decline in prices, a decrease of $1,034,390 compared with the previous year.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 24.)

Iron and Steel Institute.

The opening session of the American meeting of the Iron and Steel Institute was held in New York city last Monday. Representatives of iron and steel industries from more than a dozen countries were present. The Bessemer gold medal was presented to Mr. Andrew Carnegie, President of the Institute.

Society of Naval Architects and Marine Engineers.

At the twelfth annual meeting of this society, to be held in New York November 17 and 18, the programme will include the following papers: "Coaling of Warships at Sea," by Spencer Miller; "The Shipping and Shipbuilding of Puget Sound," by Frank W. Hibbs; "Maintenance of Machinery in Merchant Shops," by Robert Haig, and "High-Speed Gasoline Launches," by Clinton H. Crane.

Alamogordo Railway Club.

A railroad club bearing this name was organized at Alamogordo, N. Mex., October 12th. Club rooms were opened and a large number of members and invited guests were present. Meetings will be held weekly and various subjects of interest to railroad men will be discussed. Twice a month entertainments are to be given to which the public will be invited. The club is intended for social enjoyment and where members can spend their spare time. The President is E. Beazley and the Secretary C. J. Finger.

PERSONAL.

—Col. J. C. Fuller, President of the Hunters Run & Slate Belt Railroad, and for many years President of the Gettysburg & Harrisburg, died on October 19, at the age of 77.

—Press despatches from San Francisco say that Mr. C. H. Markham, Vice-President and General Manager of the Southern Pacific Company, has resigned to become General Manager of the Guffey Petroleum Company, of Beaumont, Tex.

—Mr. J. C. Hagerty, who has been promoted to the Superintendency of the Indiana Division of the Baltimore & Ohio Southwestern at Cincinnati, Ohio, to succeed Mr. Poland, has been in railroad service for the past 34 years, all of which time has been spent on the B. & O. S. W. He started as a laborer in 1870, then became switchman, and for the nine years following was a telegraph operator. Then for a number of years he was chief train despatcher, and for about four years before his recent promotion to the Superintendency, Mr. Hagerty was Trainmaster at Washington, Ind.

—Mr. Robert James Laws, Superintendent of the Sacramento Division of the Southern Pacific Company at Sacramento, died suddenly, while directing the clearing of a wreck near Yuba Pass, on the morning of October 20. Mr. Laws was 57 years old, and was a native of Cohoes, N. Y. His railroad service dated from 1868, when he began as a rodman in the engineering department of the Central Pacific (Southern Pacific). Later he became Assistant to the Resident Engineer and Roadmaster. In 1880 he was appointed Superintendent on construction on the Carson & Colorado, and the following year was promoted to be Assistant General Superintendent and Chief Engineer. In March, 1900, he went to Hawthorne, Nev., as Division Superintendent of the Southern Pacific, and was later transferred to Sacramento.

ELECTIONS AND APPOINTMENTS.

Atlanta & West Point.—A. R. Lawton has been elected a Director, succeeding John M. Egan.

Boston & Albany.—See New York Central.

Boston & Maine.—C. A. Messer, Assistant Superintendent of the Concord Division, has been transferred to the Western Division as Assistant Superintendent, with headquarters at Boston, Mass., effective Oct. 24.

Central Vermont.—C. W. Witters has been elected a Director, succeeding J. L. Martin, resigned.

Chicago, Rock Island & Pacific.—The jurisdiction of W. M. Hobbs, General Superintendent of Transportation, has been extended over the St. Louis, Kansas City & Colorado.

Cincinnati, Hamilton & Dayton.—The officers of this company are: Chairman of the Board, G. M. Cumming; President, E. Zimmerman; First Vice-President, Russell Harding; Second Vice-President (in charge of traffic), C. A. Parker; Assistant Secretary; Thomas J. Walsh, Assistant Treasurer, J. H. Howard.

Lake Erie & Western.—See New York Central.

Lake Shore & Michigan Southern.—L. G. Parish, hitherto Master Car Builder at Englewood, Ill., has been appointed Assistant Superintendent of Rolling Stock, with headquarters at Cleveland, Ohio. (See New York Central.)

Mobile & Ohio.—W. S. Cooke has been appointed General Auditor, with headquarters at Mobile, Ala., succeeding R. V. Taylor.

New York Central & Hudson River.—F. W. Brazier, hitherto Assistant Superintendent of Rolling Stock, has been appointed Superintendent of Rolling Stock of this company, with jurisdiction over the Boston & Albany, the Lake Shore & Michigan Southern and the Lake Erie & Western. F. M. Whyte, hitherto Mechanical Engineer of the New York Central, has been appointed General Mechanical Engineer, with jurisdiction over all of the above named lines. Both Mr. Brazier and Mr. Whyte will continue to have their headquarters in New York City. We understand these appointments are to take effect Nov. 1.

Norfolk & Western.—J. C. Cassell, Assistant to the President, has resigned, and that office has been abolished.

Panama Canal Commission.—George D. Brooke, who at one time was Superintendent of Machinery and Equipment of the Iowa Central and the Minneapolis & St. Louis roads, has been appointed to a position on the Commission.

Pennsylvania.—J. L. Cunningham has been appointed Foreman of Car Shops, with headquarters at Columbia, Pa., succeeding J. R. Bowie, resigned. S. G. Thomson, hitherto Foreman of Car Shops at Bedford, Pa., has been appointed to succeed Mr. Cunningham, as Assistant Master Mechanic, with headquarters at Harrisburg, Pa.

Philadelphia & Reading.—William H. Keffer, hitherto Trainmaster at Tamaqua, Pa., has been appointed Assistant to the General Superintendent, with headquarters at Reading, Pa.

Pullman Company.—L. S. Hungerford, hitherto Assistant General Superintendent, has been appointed General Superintendent, succeeding W. H. Reed, who has resigned on account of ill health.

St. Louis & San Francisco.—R. V. Miller, hitherto Superintendent of the St. Louis, Memphis & Southeastern at St. Genevieve, Mo., has been appointed Superintendent of the Southwestern Division of the St. L. & S. F., with headquarters at Sapulpa, Ind. T., succeeding C. E. Burr, resigned.

Robert Rennie, Superintendent of Shops at Springfield, Mo., has resigned, and that office has been abolished.

St. Louis, Memphis & Southeastern.—R. V. Miller, Superintendent, has resigned. (See St. Louis & San Francisco.)

St. Louis, Brownsville & Mexico.—W. P. Homan has been appointed Chief Engineer, with headquarters at Corpus Christi, Tex., succeeding F. G. Jonah, resigned.

St. Louis, Kansas City & Colorado.—See Chicago, Rock Island & Pacific.

Toledo, Angola & Western.—J. Kuttner has been appointed Traffic Manager.

Toledo Railway & Terminal Company.—W. F. Robinson has been elected President, succeeding H. E. King, and L. B. Pierce has been elected Vice-President, succeeding T. H. Tracy.

Western Maryland.—A. H. Calef (Secretary and Treasurer of the Missouri Pacific) has been elected a Director, succeeding John M. Hood, resigned.

LOCOMOTIVE BUILDING.

The Louisville & Nashville is having five locomotives built at the Rogers Locomotive Works.

The New York, New Haven & Hartford is having 20 locomotives built at the Baldwin Locomotive Works.

The Central Vermont has ordered nine passenger and five freight engines from the American Locomotive Co.

The Maine Central, as reported in our issues of October 14 and 21, has ordered four 10-wheel (4-6-0) wide fire-box freight locomotives and two 6-wheel (0-6-0) switching locomotives from the American Locomotive Co. The 10-wheel engines will be built at the Schenectady Works and the switching engines at the Brooks Works.

The Chicago & North Western is having 16 locomotives built at the Schenectady Works of the American Locomotive Co. These locomotives will be of the standard type which has been used by the company now for four or five years, with the exception that the tender will have a capacity of 7,500 gallons and the wheel base will be 14 ft. 10 in. instead of 11 ft. 8 in., as heretofore.

The Chicago, Burlington & Quincy has ordered 50 simple Prairie-type (2-6-2) locomotives from the American Locomotive Co. These locomotives will weigh 209,000 lbs., with 151,000 lbs. on the drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 69 in.; radial stay boiler, with a working steam pressure of 210 lbs.; heating surface, 3583.4 sq. ft.; 301 tubes, 2¼ in. in diameter and 19 ft. long; fire-box, 9 ft. long and 6 ft. wide; grate area, 54.2 sq. ft.; tank capacity, 8,000 gallons of water, and coal capacity, 16 tons.

CAR BUILDING.

The Tehuantepec National is about to purchase one private car.

Barney & Smith are asking prices on special equipment for 200 cars.

The Chicago, Rock Island & Pacific is in the market for three passenger cars.

The American Car & Foundry Company has miscellaneous orders for 100 cars.

The Pere Marquette has ordered 100 ballast cars from the Rodger Ballast Car Co.

The State Railway of Chili is reported in the market for from two to five dining cars.

The Ingoldsby Automatic Car Company is having five freight cars built by the Pullman Co.

The Panama Canal Commission has ordered 200 flat cars from the Standard Steel Car Co.

The Illinois Central has asked bids on 500 36-ft. steel underframe box cars of 80,000 lbs. capacity.

The Chicago, Milwaukee & St. Paul is reported to have ordered four dining cars from Barney & Smith.

The Pennsylvania is having 200 coke cars built at the McKees Rocks Works of the Pressed Steel Car Co.

The Northern Pacific is reported in the market for 1,000 gondolas, and possibly some additional box cars.

The Armour Car Lines are buying material for 300 of their standard fruit cars to be built at their own shops.

The Chicago, Indianapolis & Louisville is reported about to let contracts for 750 36-ft. box cars of 80,000 lbs. capacity.

The Cherokee Construction Company is having 25 freight cars built by the Mount Vernon Car Manufacturing Co.

The Mather Stock Car Company is reported to be having 800 stock cars built by the South Baltimore Steel Car & Foundry Co.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered 1,000 box cars and 200 flat cars from the American Car & Foundry Co.

The Hocking Valley has ordered 200 box cars from the American Car & Foundry Co. This is in addition to the order reported in our issue of September 30.

The Chicago, Burlington & Quincy, as reported in our issue of October 21, is considering the purchase of 1,000 box cars of 80,000 lbs. capacity. These cars will be 40 ft. long, 8 ft. 6 in. wide and 8 ft. high.

The Atlantic Coast Line has ordered 500 box cars from the South Baltimore Steel Car & Foundry Co. This order is in addition to the one for 500 cars recently placed with the same company. The specifications for these cars were given in our issue of September 9.

The New York Central & Hudson River has increased its orders for coal and box cars from 1,500 to 2,000 each. These cars will be equally divided between the Western Steel Car & Foundry Co. and the American Car & Foundry Co., as reported in our issue of October 14.

The Toledo, St. Louis & Western has ordered 20 cabooses from the American Car & Foundry Co. for November delivery. They will be 18 ft. long over end sills, 9 ft. wide over side sills and 6 ft. 2 in. high from sill to plate. Special equipment includes Sterlingworth brake-beams, Tower couplers, pressed steel journal box lids and American Car & Foundry Co.'s wheels.

The Toledo & Ohio Central and the *Kanawha & Michigan*, as reported in our issue of October 21, have each ordered 100 box cars of 60,000 lbs. capacity from the American Car & Foundry Co. These cars will be 36 ft. long, 8½ ft. wide and 8 ft. high, all inside measurements. The special equipment includes: Simplex bolsters and brake-beams, Magnus Metal Co.'s brasses, Tower couplers, Security door fastenings, McCord dust guards, journal boxes and lids, Excelsior roofs and Railway Steel-Spring Co.'s springs.

The Lehigh Valley has ordered two café coaches from the Barney & Smith Car Co., for December 15 delivery. These coaches will be 70 ft. long, over end sills; 9 ft. 8 in. wide, over sills, and 14 ft. 4 in. high, over ventilators. The special equipment includes: "Diamond" special brake-beams, Westinghouse air-brakes, Magnus Metal Co.'s brasses, National couplers, Symington dust guards, journal boxes and lids, Consolidated heating system, Pintsch gas, Standard platforms, Ludlum springs, six-wheel trucks, Pullman vestibules and Paige steel tired wheels.

BRIDGE BUILDING.

ALTOONA, PA.—At a meeting of the Pennsylvania officials and the borough officials of Lilly, it was decided to have County Surveyor Elder prepare plans and estimate the cost of a bridge at this place.

ANNAPOLIS, MD.—Bids are wanted November 1 by Anne Arundel County Commissioners for building an iron bridge over the Patapsco River at or near the present wooden structure known as the Sweetser bridge.

BATTLEFORD, SASKATCHEWAN.—Plans and specifications have been approved for the Canadian Northern Railway bridge over the North Saskatchewan River near this place, superstructure to consist of nine deck spans and two through spans. M. H. McLeod, Winnipeg, Man., is Chief Engineer.

BUFFALO, N. Y.—Press reports state that the Delaware, Lackawanna & Western, the Lake Shore & Michigan Southern and the New York, Chicago & St. Louis, have agreed to jointly make extensive improvements, which will include the elevation of a long stretch of track and the building of a viaduct.

CALGARY, ALBERTA.—Bids are wanted by H. Gillie, City Clerk, November 12 for building a 180-ft. steel truss bridge on foundations now ready. F. W. Thorold is City Engineer.

JEFFERSON CITY, TENN.—An iron or steel bridge will be put up by Jefferson County over Massy creek. J. T. Holt, Clerk, Dandridge, Tenn.

KINGFISHER, OKLA. T.—Kingfisher County, reports say, will build about 18 new bridges.

KINSTON, N. C.—The Kinston & Carolina Railroad Co., reports say, will build an iron bridge on its road 300 ft. long, with a steel draw.

LITTLE FALLS, MINN.—Bids are wanted November 11 by the Board of County Commissioners for building a 75-ft. high-truss steel bridge over the Platte River at Agram. W. A. Butler is County Auditor.

LOS GATOS, CAL.—Plans have been accepted by the Los Gatos Council and a vote will be taken to issue bonds for building a concrete bridge 180 ft. long and 70 ft. wide, with 12 ft. sidewalks, to replace the present wooden bridge over the creek on Main street.

MITCHELL, S. DAK.—Bids are wanted November 16 by the County Auditor for a steel bridge 60 ft. long.

MONROE, LA.—A contract has been given to M. S. Hassle, Jr., of Dallas, Tex., at $12,568, for building six small bridges.

MONTREAL, QUE.—The Canadian Pacific has plans ready for building a number of bridges, the steel superstructures being: one 150 ft. and four 100 ft. through spans; two 80 ft., one each 50, 40, 30 and 20 ft. deck plate girder spans; two 80, one each 60, 40 and 20 ft. half deck plate girder spans. W. F. Tye, Montreal, Chief Engineer.

OTTAWA, ONT.—The city and county will remove the embankment at the eastern approach of the Canadian Pacific bridge over the Rideau River and build a steel bridge with a clear span of 150 ft. in its place.

The Department of Railways and Canals asks bids until Nov. 8 for the substructure of a bridge over the Lachine Canal at Atwater avenue, Montreal.

PORTSMOUTH, OHIO.—Plans have been completed by Engineer Pratt and will be submitted to the Council for building a stone culvert over Lawson's run to cost about $18,000.

SANTA CRUZ, CAL.—At a joint meeting of the supervisors of Santa Cruz and San Benito Counties, a contract was given to the Pacific Construction Co. to build a steel bridge over the Pajaro River at $10,896.

TERRE HAUTE, IND.—Bids are wanted November 14 for building the Meneely bridge in Nevins township and the Jencks bridge in Otto Creek township, in Vigo County. Jerome W. Denehie is Auditor.

Other Structures.

ALBINA, ORE.—Press reports state that the Oregon Railroad & Navigation Co. is making plans to put up new buildings, for which bids will soon be asked, including the following: A machine shop 160 x 338 ft., to cost $95,000; a 22-stall addition to the roundhouse, to cost $56,000; a paint shop 80 x 544 ft., to cost $45,000; transfer tables 80 x 773 ft., to cost $26,000; coal chutes, to cost $5,000, and a storehouse 80 x 200 ft., to cost $5,000.

COLUMBUS, OHIO.—A large new freight house will be built this fall at Columbus for the Baltimore & Ohio, for which a contract has been given to James A. Stuart & Co., of Pittsburg, at about $100,000.

FERRIDAY, LA.—Bids are now being asked by B. S. Wathen, Dallas, Tex., Chief Engineer of the Texas & Pacific, for putting up

a brick station two stories high, 42 ft. x 180 ft., on which work will begin early next month; bids are in for a brick and cement roundhouse to have 15 stalls and costing $25,000, but the contract has not yet been awarded.

GRAFTON, W. VA.—The Baltimore & Ohio has given a contract to Patrick Farrell, of Cincinnati, Ohio, for building a 10-stall roundhouse to cost about $40,000.

GULFPORT, MISS.—The Gulf & Ship Island Railroad will put up a new building with its own forces next month, to cost about $10,000.

MORGANTOWN, W. VA.—An extension to the freight shed and platform of the Baltimore & Ohio station will be built at a cost of about $10,000, for which a contract has been given to Holbert & Spedden, of Fairmont, W. Va.

NASHVILLE, TENN.—The Nashville, Chattanooga & St. Louis freight house was damaged by fire October 19; loss on house and contents about $100,000. The building, which cost $72,000, will be rebuilt at once.

TOLEDO, OHIO.—At the annual meeting of the Wabash, it was stated that a new passenger station will be built in Toledo to cost about $500,000.

TORONTO, ONT.—The Railway Commission on October 12 decided to pass an order to secure to the various railroad companies the land required as a site for the union passenger station.

UNIONTOWN, PA.—A contract has been given by the Baltimore & Ohio to T. E. Hill & Co., of Chicago, for a new passenger station to cost about $10,000.

WILMINGTON, DEL.—A building permit has been taken out by the Pennsylvania for a freight house at Third and Pine streets, to cost about $12,000.

YOUNGSTOWN, OHIO.—In connection with the rebuilding of the Newcastle division of the Baltimore & Ohio, a new station to cost $50,000 will be put up. Niedermeier & Restle, of this place, have the contract.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATLANTA, KNOXVILLE & NORTHERN.—A contract has been let to Wright, Williams & Wadley, of Birmingham, for building the 88 miles of line between Wetmore, Tenn., and Cartersville, Ga. It is stated that work will be begun at once. (August 26, p. 73.)

AURORA, DE KALB & ROCKFORD (ELECTRIC).—Work has been begun on this proposed line from Aurora, Ill., northwest to De Kalb, 29 miles. W. C. Ross & Co., National Life Building, Chicago, are the contractors. The line will eventually be extended north to Rockford, 60 miles from Aurora. Thomas Wooster, Aurora, Ill., is President.

BLACK BAYOU.—A charter has been granted this company in Texas to build a railroad from Myrtis, La., to Stanley, in Cass County, Tex., 25 miles. C. B. Crawford, Atlanta, Tex.; R. McMichael, Jefferson, Tex., and others are incorporators.

BUFFALO & SUSQUEHANNA.—See Railroad Corporation News.

CALIFORNIA NORTHWESTERN.—Grading is reported in progress on a branch line from Reclamation, Cal., northeast to Napa, 10 miles. T. Mellersh, San Francisco, is Secretary.

CATLIN & NORTHERN.—This company has been incorporated in Illinois to build from Catlin northwest to Oakwood, six miles. Connection will be made with the Wabash at the former point and with the Big Four at the latter. L. E. Fisher, G. T. Buckingham and W. V. Dysert, all of Danville, Ill., are incorporators.

CENTRAL CALIFORNIA.—Articles of incorporation have been filed by this company in California. It is proposed to build a railroad which will run from Newark, in Alameda County, west to San Francisco Bay at Potraro Point, and thence across the bay to San Mateo. It is said that this is a favorable place for bridging the bay. The total length of the projected road is 15 miles and the authorized capital of the company is $1,000,000. M. T. Smith, William Hood, J. E. Foulds and others are interested. The line is said to be a Southern Pacific project.

DELAWARE & LACKAWANNA TUNNEL RAILROAD.—This company has been incorporated in New York in the interest of the Delaware, Lackawanna & Western Railroad to build and operate a tunnel under the Hudson River from Hoboken, N. J., to Manhattan, New York. The incorporators include: W. H. Truesdale, E. E. Loomis, O. C. Post, Thomas W. Lee, George F. Wilson, A. D. Chambers, F. F. Chambers, W. S. Maguire and W. W. Ross, all of New York. Mr. Ross, General Attorney of the railroad, says that the tunnel company will be purely a subsidiary company of the D., L. & W., and will be financed entirely by the railroad company. Nothing definite in the way of plans has as yet been decided upon.

DES MOINES WESTERN.—It is announced that this company will shortly begin work on a belt line around the city of Des Moines which will connect with all the brick and coal industries around the city. Surveys are now in progress. Tracks will also be built to plants in the neighborhood of Carbondale and Youngstown.

EL PASO, MOUNTAIN PARK & ST. LOUIS.—A charter has been filed by this company in Oklahoma Territory with an authorized capital of $7,000,000. R. K. Kelly, W. P. Bryan, M. Roberts and A. Osburn are named as incorporators. The principal office of the company will be at Mountain Park.

FORT SMITH & GURDON (MISSOURI PACIFIC).—According to press reports, contracts have been let for building this line as an extension of the St. Louis, Iron Mountain & Southern from Gurdon, Ark., to Greenwood, 120 miles. The Dalhoff Construction Co. will do the work.

GRAND RAPIDS & IONIA.—A contract for grading this proposed electric railroad from Grand Rapids, Mich., east to Ionia, 30 miles, has been let to Carlin & Co., of Canton, Ohio. The line parallels the Grand Trunk between these points. E. M. Hopkins, Detroit, is President, and C. H. Pomeroy, Saginaw, Treasurer. (See Construction Supplement.)

GUTHRIE, FAIRVIEW & WESTERN.—According to press reports, this road, which was chartered a little less than a year ago, has surveyed its line from Guthrie, Okla. T., northwest to Fairview, 70 miles. The promise is made that grading will be begun about January 1, and bids for the work will be asked at that time. The new line will connect with the Kansas City, Mexico & Orient at Fairview. The work is light, with a maximum grade of .8 per cent. W. S. McCaull, Guthrie, Okla. T., is President. (June 10, p. 450.)

IMBODEN & ODELL.—Grading has been completed on the first 10 miles of this line running from the mouth of Blue Creek, W. Va., east to Belva, on the Gauley River branch of the C. & O. Track laying is in progress, and it is stated that this portion of the line will be opened for traffic before the end of the year. C. P. Peyton, Charleston, W. Va., is Chief Engineer. (March 18, p. 222.)

INTERBOROUGH RAPID TRANSIT COMPANY (NEW YORK CITY).—The subway was opened for traffic on October 27 at 7 p. m., from the City Hall northward to 145th St. and Broadway. The line on the East Side, into the Borough of the Bronx, will not be opened for several weeks.

KANSAS & OKLAHOMA INTERURBAN.—A territorial charter has been issued to this company. Its headquarters will be at Kansas City and the authorized capital is $1,000,000. The proposed road includes the city lines in Arkansas City and Winfield, with connecting lines to Gueda Springs, Kan., and Chiloco, Okla. T. A. J. Hunt, Arkansas City; W. C. Robinson, Winfield, Kan., and Charles Johnson, Newkirk, Okla. T., are among the incorporators.

KNOXVILLE, LA FOLLETTE & JELLICO.—This entire line, running from Saxton, Ky., to Knoxville, Tenn., has been finished, with the exception of three miles of track between the Clinch River and Dossett. Work is being pushed on the Dossett tunnel, and, as soon as this and the remaining three miles are completed, the line will be opened for traffic. It is reported that work will be begun in a few days on the Cow Creek branch running from Dossett to Oliver Springs, 12 miles. (See Construction Supplement.)

LIBERTY CITY, GLENNVILLE & MANASSAS.—This company, which was recently chartered in Georgia, will build a railroad from Liberty City to Manassas, about 40 miles. The name of the company was incorrectly given in our issue of October 14 as Glennville & Manassas. H. W. Tippins, Manassas, Ga.; W. H. Bradley, Waycross, Ga.; J. K. Hines, Atlanta, Ga., and others are incorporators.

MINIDOKA & SOUTHWESTERN (OREGON SHORT LINE).—It is announced that the Oregon Short Line will soon begin work on the construction of its Minidoka & Southwestern branch. The line is projected to run from Minidoka, Idaho, southwest through Lincoln County to a point on the Salmon Falls River, in Cassia County, 85 miles. (See Construction Supplement.)

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—On the new Winnipeg line, north to Thief River Falls, the roadbed has been graded to Emerson, where connection is made with the Canadian Pacific. Track laying, which is about half completed between Thief River Falls and Emerson, 80 miles, is progressing at the rate of about three miles a day.

MORGANTOWN & KINGWOOD.—A contract for building the extension from Bretz, W. Va., north to Kingwood, 15 miles, has been let to Talbot Bros., of Fairmont, W. Va. It is the intention of the company to eventually extend the line to Rowlesburg, 17 miles further. A. S. Brady, Morgantown, W. Va., is Chief Engineer. (September 23, p. 103.)

NEW YORK, PENNSYLVANIA & SOUTHWESTERN.—A contract has been let to Rogers & Co. for building this proposed road from Williamsport, Pa., northeast to Binghamton, N. Y., a distance of 116 miles. Work will be begun at once at Wyalusing. This company was originally chartered in 1890 as the Binghamton & Southwestern. The capital of the new organization is $9,000,000. C. B. Miller, Assistant Corporation Clerk of the Pennsylvania State Department, is said to be interested.

OAKLAND & MARYSVILLE.—Articles of incorporation have been filed by this company in California with an authorized capital of $4,000,000. It is proposed to build a railroad from a point on the Oakland waterfront in an easterly direction through the counties of Alameda, Contra Costa, Solano and Yolo to Sacramento, and thence to Marysville, 135 miles. W. B. Cope, F. W. Zeile, J. D. McKee and others, of Oakland, are incorporators.

PAMLICO, ORIENTAL & WESTERN.—*The Manufacturers' Record* has the following to say with regard to the progress of the work on this line now building from Newbern, N. C., to a point on Pamlico Sound: "The bridge of 5,500 ft. across the Neuse River is about 75 per cent. completed, and the steel draw is now being placed in position. It is expected to have this part of the work ready for trains by Nov. 20. About five miles of track have been laid and about seven miles graded ready for ties and rails. The company expects to have the first 17½ miles as far as Bayboro completed by the first of January. The W. A. Cullen Construction Co., 25 Broad street, New York City, is the contractor."

QUEBEC & LAKE ST. JOHN.—A contract has been let by this company to E. Conway for building a branch from St. Gabriel to Gos-

ford, 15 miles. It is expected to have the first five miles of the line finished by the end of the year.

St. Joseph, Albany & Des Moines (Electric).—Surveys for this proposed line from St. Joseph, Mo., northeast to Des Moines, Iowa, 130 miles, have been furnished and rights of way are now being secured. Arrangements have been made for the use of the tracks of the Des Moines Union Co. for terminals at Des Moines, and similar arrangements have been made for the use of the tracks of the Union Terminal Co. at St. Joseph. F. S. Mordaunt, of Chicago, who is interested, is reported as saying that work will be begun in the spring.

St. Petersburg & Gulf.—Incorporation has been granted this company in Florida to build a railroad from St. Petersburg to the gulf coast, eight miles. F. A. Davis, W. L. Haddock and others, of Philadelphia, Pa., are interested.

Savannah, Shiloh Park & Corinth.—A charter has been granted this company in Tennessee. It is proposed to build a railroad from Allen's Creek, in Wayne County, Tenn., west through Savannah and Shiloh National Park, in Hardin County, to Corinth, in Alcorn County, Miss., 40 miles. J. J. Williams, D. A. Welch, E. P. Churchwell, A. W. Ross and others are named as incorporators.

Savannah, Statesboro & Northern.—This company has applied for a charter in Georgia to build a railroad 160 miles long from Statesboro to Louisville, from Louisville to Thomaston and from Thomaston to Washington. B. T. Outland and J. S. Franklin, Portal, Ga., and others are incorporators. The principal office of the company will be at Savannah.

Southern Pacific.—Press reports state that the Carson & Colorado, running from Moundhouse, Nev., to Keeler, Cal., 293 miles, will be converted into a standard-gage line and the work to be begun at once.

Texas Roads.—The Northern Texas Construction Co. has been organized for the purpose of building 750 miles of railroad in the western part of Texas. The main line is projected to run from Amarillo to San Antonio, 450 miles, with a branch line from Amarillo to El Paso, 300 miles. C. L. Townridge, Chicago, is named as the promoter.

According to press reports, Col. E. D. Steger, of Bonham, Tex., has organized a company with a capital of $78,000,000 to build a railroad from Duluth, Minn., to Galveston, Tex., 2,800 miles. The last project of this kind specified the number of main tracks (four). Colonel Steger will have to have six, or take a back seat.

Union Pacific.—Press reports state that work will be begun within 10 days on a cut-off between Monoken, Kan., and Marysville, 80 miles. The contract has already been let to Kilpatrick Bros. & Collins, of Beatrice, Neb. (September 23, p. 104.)

Wisconsin & Illinois.—The proposed route of this road, which was recently incorporated in Wisconsin, is from Warren in a southwesterly direction through Platteville, Lancaster and Hazel Green to East Dubuque, 98 miles. M. S. Sickle, A. W. Kopp and others, of Platteville, are incorporators. (October 21, p. 133.)

RAILROAD CORPORATION NEWS.

Chicago Great Western.—See Union Pacific.

Detroit & Mackinac.—The report of this company for the fiscal year ending June 30 shows gross earnings of $981,315, an increase of $27,607. Operating expenses were $603,157, an increase of $26,507. The ratio of expenses to earnings increased from 60.46 to 62.70, due to higher charges in the maintenance of way account because of extremely bad weather and heavy floods in the early spring. Freight earnings were increased $15,011, and passenger earnings $9,178. A decrease in the average train load from 252 tons to 230 tons was offset by the slightly higher ton-mile revenue, which increased from .97 cent to 1.01 cent.

Lehigh Valley.—At a meeting of the Board of Directors of this company on October 19, the sale of the $15,000,000 general consolidated mortgage 4 per cent. bonds was approved. The directors also authorized the publication of a notice calling for the payment on December 1, 1904, of the $2,000,000 outstanding 5 per cent. bonds, of the $3,000,000 coal pledge securities, and on May 1, 1905, of the oustanding 5 per cent. collateral trust bonds.

Maryland, Delaware & Virginia.—*The Commercial & Financial Chronicle* gives the following statement with regard to the recent consolidation of the railroad and steamboat interests into this company. The common stock is to be $1,500,000; preferred stock, $1,500,000 4 per cent. non-cumulative; new bonds authorized, $2,000,000, of which issue $1,750,000 will be subject to the lien of the $330,000 preference bonds of the Queen Anne's railroad. The consolidated mortgage bonds of the Queen Anne's railroad will receive $1,200 per bond in preferred stock, the income bonds will receive $5 per hundred for their holdings and the common stock will be about $1 per hundred—all of the above to be paid in preferred stock. It is said that a majority of the Queen Anne security-holders have consented to the plan. (October 14, p. 126.)

Northern Pacific.—This company has declared a quarterly dividend of 1½ per cent. and an extra dividend of 1¼ per cent., payable November 1. The last dividend, which was paid in February, was 1½ per cent.

Pennsylvania.—The extensive new freight terminal of this company at Greenville, N. J., on New York Bay, about three miles south of Jersey City, was partially opened for business October 17. This line connects with the main line of the New York division of the Pennsylvania south of Newark. It crosses Newark Bay by a long bridge, in the middle of which is a draw, used jointly by the Pennsylvania and the Lehigh Valley, which has another bridge near by. At Greenville freight cars are delivered to floats to be carried to all parts of New York Harbor.

South & Western.—Announcement has been made that this road, running from Johnson City, Tenn., to Spruce Pine, 64 miles, has been sold to a syndicate of capitalists known as the Clinchfield Corporation. Extensions amounting to 65 miles will probably be built, although no definite plans have been given out.

Union Pacific.—The annual report for the 12 months ending June 30 shows gross earnings of $55,279,231, an increase of $4,204,042. Operating expenses were $30,497,443, an increase of $1,750,227, leaving an increase in net earnings of $2,453,815. The report tells of the purchase by the Oregon Short Line of one-half interest in the San Pedro, Los Angeles & Salt Lake Railroad. This road is now being built from San Pedro and Los Angeles, Cal., to Salt Lake City, Utah, with several branches. The stretch of 80 miles between Caliente, Nev., and Daggett, Cal., is now being graded, and it is stated that trains will be running through from San Pedro to Salt Lake by February 1 of next year.

Recent marked advances in the price of the stocks of the Union Pacific and the Chicago Great Western appear to give substance to the report that the U. P. has an option for the purchase of the Chicago Great Western. President Stickney, asked to confirm the rumor, had "nothing to say for publication." On the New York Stock Exchange last Tuesday 108,600 shares of Union Pacific stock were dealt in during the first 35 minutes, and 352,200 shares during the day, the price at one time being 3½ points over Monday's close.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY BY
THE RAILROAD GAZETTE
At 83 Fulton St., New York.

EDITORIAL ANNOUNCEMENTS:

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages and all of the advertisement pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name, Transport and Railroad Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

FRIDAY, OCTOBER 28, 1904.

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